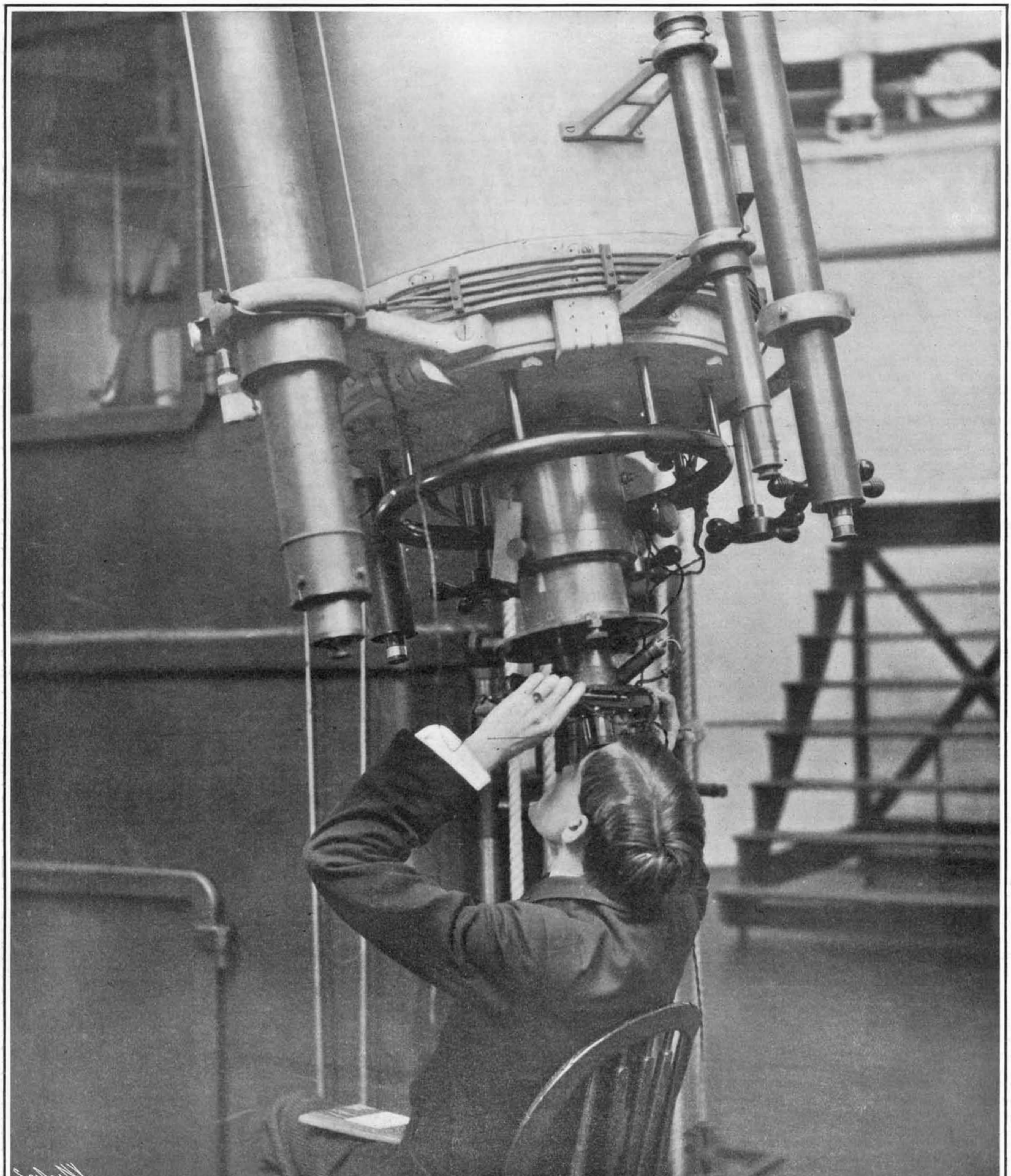
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1905, by Munn & Co.]

Vol. XCIII.—No. 18. ESTABLISHED 1845. | NEW YORK, OCTOBER 28, 1905. | 10 CENTS A COPY. $3.00 A YEAR.



THE TWENTY-SIX-INCH TELESCOPE OF THE UNITED STATES NAVAL OBSERVATORY.—[See page 336.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845) .... $3.00 a year
Scientific American Supplement (Established 1876) .... 5.00 "
American Homes and Gardens .... 3.00 "
Scientific American Export Edition (Established 1878) .... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.

Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, OCTOBER 28, 1905.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A LESSON FROM THE LEWIS AND CLARK FAIR.

The city of Portland, Ore., is to be congratulated on the fact that in the highly successful Lewis and Clark Fair, recently closed, it has proved that by the exercise of careful forethought and good management it is possible to carry through one of these national expositions as a paying proposition, and turn over a cash dividend to the stockholders at its close. No doubt one secret of its success is to be found in the fact that the Fair was planned on a scale commensurate with the present stage of development of the Pacific Coast, and that a conservative estimate was made of the probable number of visitors. That the gate returns should have shown a total admission of 2,500,000 is a highly creditable result, and particularly so when we bear in mind that the total population of the State in which the Fair was held is less than one-fifth that number.

We have long been of the opinion that these national expositions have grown altogether too big and cumbersome. The two elements of bulk and acreage, which have been blazoned as their chief glory, are really their chief defect, and the bane of every weary pilgrim that has toiled through their miles of boulevards and plazas, or plodded through aisles of interminable length and oppressive monotony. When such Brobdingnagian buildings as those of the St. Louis Fair are scattered over two square miles of territory, it is clear evidence that the builders have lost all sense of proportion; for only a race of giants, striding ten feet to our one, could cover such an exposition with any degree of comfort, or in any reasonable time.

If we make our future expositions smaller, we can fill them with more select exhibits. The commissioners will be more concerned about the quality and less about the quantity. Where such an enormous building, for instance, as the Agricultural Palace at St. Louis is put up, it becomes a problem how to fill it; for on a floor space measuring 500 feet by 2,000 feet, there are bound to be whole acres of stock exhibits which are simply repetitions of other acres similarly filled.

Nor are such vast proportions necessary to produce the desired architectural results. If the St. Louis buildings and grounds had been scaled down nearer to the proportions of those at Portland, the effects (landscape, architectural and illuminative) would have been scarcely less striking, and the proper acquaintance and appreciation of them would not have entailed such mental and physical exhaustion. Furthermore, a reduction in the scale of future world's fairs would not only serve to get rid of many miles of stock exhibits, such as may be seen in a day's walk through any large city's business center, but it would bring the first cost and operating expenses down to a point at which, as in the Lewis and Clark Fair, the customary deficit would give place to a cash dividend.

LONG-SPAN BRIDGES OF THE WORLD.

It is surely a sign of the great magnitude of the engineering works of the present day, and the multiplicity of such works, that the magnificent bridge which is being thrown across the St. Lawrence at Quebec should have attracted so little public attention. Time was, and not so very long ago, when the spanning of a broad river or estuary like the St. Lawrence or the Firth of Forth, held the attention and commanded the admiration of the whole world. It was thus when the Roeblings spun that seemingly delicate cobweb of wires across the East River, New York, which is now world-famous as the Brooklyn Bridge. It was so when, a few years later, Sir Benjamin Baker and his associates boldly set out to build a double-track steel highway across the stormy Firth of Forth, a few miles above Edinburgh, announcing that they intended to cross the channel in two bold leaps each of 1,710 feet, with the historic Inchgarvie Island as a single intermediate stepping-stone. In each case, the work of building these monumental engineering structures was followed in its successive details with absorbing interest, from the sinking of the huge caissons and rooting them to the solid rock far below the river bed, to the erection of the giant towers and the stringing of the airy cables, or flinging out the giant cantilever arms to join hands in midstream, nigh upon a thousand feet from the points of support.

Bridge building upon a Titanic scale was a novelty in those days, and comparatively novel also were the sinking of wooden or steel caissons through water and underlying mud and sand to a rocky bed, and the outbuilding of gigantic trusses, hundreds of feet beyond their point of support without the aid of temporary falsework or scaffolding. Familiarity, however, even in engineering works of great audacity and difficulty, breeds the inevitable contempt, and hence it is that the spanning of the St. Lawrence has awakened an interest that is almost purely academic and confined largely to the technical press and to the limited circles of our engineering societies.

The great cantilever bridge which is now being built across the St. Lawrence River at Quebec will include the largest single span ever erected in the history of the world. It is well understood among engineers that the true test of the magnitude of a bridge is not its total length as made up of many individual spans, but the length of the individual span itself, and in this respect the Quebec Bridge is preeminent. It reaches across the St. Lawrence River in a single span of 1,800 feet. This is nearly 100 feet greater than the spans of the Forth Bridge cantilevers, which measure 1,710 feet in the clear. Next in length is the Williamsburg suspension bridge, which is 1,600 feet in the clear, and then follow the Brooklyn Bridge, 1,595 feet, and the new Manhattan Bridge adjoining it, which will be 1,470 feet in the clear. Had the various railroads which have their terminals in Jersey City shown the same liberality and zeal displayed by the Pennsylvania Railroad Company a few years ago, there would now have been under construction, across the North River, a colossal suspension bridge, which would have far exceeded in size and importance the great bridges above mentioned. We refer to the North River suspension bridge, designed by Gustav Lindenthal, which would have crossed the North River with a single span 3,100 feet in length between the towers, and would have measured 7,340 feet over the anchorages. The cables, each 8 feet in diameter over the outer covering, would have carried a triple-deck suspended structure, with a promenade on the upper deck, six railroad tracks on the middle deck, and eight railroad tracks on the lower deck; and over this single structure it was intended to have brought in all the traffic of the Jersey roads to a single station in the heart of Manhattan. The four towers carrying the cables would have been 550 feet in height, the same as that of the Washington monument. This wonderful structure came very near to being built, and had the work been put through it would have constituted the noblest work of engineering in this or any other country in the world.

Although the new St. Lawrence Bridge will exceed our East River bridges in total length of span, it will not compare with them in the magnitude of the traffic that it can carry. Its total width of 75 feet is not much more than half that of the Williamsburg Bridge, which measures 120 feet over all and provides two 18-foot roadways, four trolley tracks, two elevated tracks, two passenger footways, and two bicycle tracks. Even greater than this is the capacity of the new Manhattan Bridge which, on the lower deck, provides for four lines of street cars, two passenger promenades, and a broad carriageway 35½ feet in width, and also carries on the upper deck four elevated railway tracks. The total width of the floor of this bridge will be 122 feet.

As the St. Lawrence Bridge is the first cantilever structure that compares in magnitude and length of span with the Forth Bridge, the latter forms the proper basis of comparison. At the time that it was constructed the engineers, who were responsible for its design, had absolutely nothing to guide them in the way of long-span railroad bridges, since nothing approaching the proposed bridge in magnitude had hitherto been constructed. In determining what section to use for the members of the cantilevers, it was decided to use the tubular section, for the reason that it presented the stiffest and strongest form for a given weight of material. It was also decided, in view of the fact that abnormally high wind stresses had to be provided for (56 pounds to the square foot), to give a very pronounced batter or inclination to the towers and cantilevers. Both of these features added greatly to the labor and cost of construction. In the interim since the building of the Forth Bridge, we have learned that wind-pressures on long-span bridges are much less than was supposed, being, indeed, scarcely half as great. Moreover, steel mills can now furnish rolled rectangular steel in sizes which were not obtainable when the Forth Bridge was built. Consequently, the St. Lawrence bridge is being built with its cantilevers and towers in vertical planes, and the materials used are entirely of standard shapes, such as can be rolled in the mills. Instead of the 12-foot tubes of the Forth Bridge, we have built-up lattice chords and posts and 18-inch eye-bars in the Quebec Bridge, and the combined result will be a structure relatively lighter and cheaper to build, and of unquestionably more graceful appearance than the far-famed bridge across the Firth of Forth.

LIFE ON OTHER WORLDS.

The recent utterances of the venerable Dr. A. R. Wallace, fellow-discoverer with Darwin of the origin of species, tending to show that our earth is the only body in the known creation suited for life such as we find it here upon the globe, has awakened a wide interest among progressive scientists. It is recognized by all who keep up with the thought of the age that evolutionists are not so sweeping in their claims now as they were a quarter of a century ago, when the Darwinian theory was new.

Dr. Wallace is now a very old man, and like Lord Kelvin, he seems to find a Providential design in the arrangement of the material universe. It is perhaps true that the very greatest and best-balanced minds of all ages have inclined to such beliefs, and yet in recent years the progress of applied science has been so sweeping and her voice so omnipotent that many persons have shared Tyndall's views of testing the efficacy of progress by experiment. The difficulty is that such tests could never be carried out satisfactorily.

Now, when Dr. Wallace asserts that our earth is the sole abode of life in the universe, a renewed interest springs up among scientists. One school claims that he is old and in his dotage; the other, that he has become wise in his old age.

Astronomers can see with a great modern telescope at least 100,000,000 stars in the entire universe. The question arises, "How many other bodies like our earth exist in space?" Prof. T. J. J. See, of the United States navy, claims that the study of the double stars rather supports Dr. Wallace's contention. In 1896, Dr. See published a work on the orbits of all the double stars which could be determined at that time, and he found the double stars so different from the solar system that he says no other system like that to which the earth belongs is known to exist in the heavens. The double stars revolve in orbits of high eccentricity, and the two members of a system are usually equal or comparable in mass; while our planets move in very circular orbits, and have masses which are infinitely small compared to that of the sun, about which they revolve. The result is that our planetary system affords equable conditions of heat and light, such as organic life requires, while the system of the double stars would furnish such great changes of light and heat that life could not survive on a planet attached to a member of a double, such as Sirius or Procyon.

The sun has a mass 746 times greater than all the planets combined, and this makes him an autocrat over the planets, whose motions he dominates absolutely. The double stars are in reality systems of double suns, and mathematicians claim that a planet could not move safely and quietly in such a system—that it would sooner or later come into collision with one of the stars, or be driven from the system never to return, in either case destroying the chances of organic life. The number of dark bodies in the heavens is immense, and, of course, it is possible that some of these may afford conditions suitable for organic life; but up to this time, astronomers are unable to point to a single body of this kind outside of our solar system. This in a measure supports the contention of Dr. Wallace.

Speaking of dark planets attending the stars, Dr. See writes in a recent publication as follows: "If such inconsiderable companions as our sun possesses attend the fixed stars, they would neither be visible nor could they be discovered by any perturbations which they might produce. It is, therefore, impossible to determine whether the stellar system includes such bodies as the planets, and we are thus unaware of the existence of any other system like our own. On the other hand, the heavens present to our consideration an infinite number of double systems, each of which is divided into comparable masses. These double systems stand in direct contrast to the planetary system, where the central body has 746 times the mass of all the other bodies combined.

In binary stars, the mass distribution is essentially double, while in the solar system it is essentially single; whether observation will ever disclose any other system of such complexity, regularity, and harmony as our own is an interesting question for the future of astronomy.

It thus appears that so far as telescopic research has yet extended, we know of no other world suited for life outside the solar system. For some reason, our system appears to be absolutely unique in the known creation; but of course astronomers are too conserva-

tive to say that no other like it will ever be discovered.

But they seem to think that our earth is very much the best abode for life ever discovered by astronomers. Mars is the only other heavenly body yet known, with conditions approximately adapted to the maintenance of life such as we know it upon the earth; and it is probable that if a strong, healthy man could be suddenly transported to our sister planet, he would be able to breathe and live there for a time. It has a rare atmosphere, water, snow, and ice, day and night, and seasons very much like those upon the earth. But, of course, it is not possible to say that man could flourish on a planet like Mars any more than he can flourish on the tops of the highest peaks of the Andes or Himalayas.

THE FIRST TOOLMAKERS AND THEIR METHODS.

Of man's existence during the geological period known as the Quaternary, or diluvial, we have evidence in his exhumed bones as well as in his flint implements. The latter bear obvious and unquestionable marks of human workmanship and, in most instances, are specialized, or made for certain definite uses. From their varying character this long period has been divided into the palaeolithic or earlier stone age (*époque de la pierre taillée*) in which the tools are merely rough chips or splinters of flint, and the neolithic or later stone age (*époque de la pierre polie*), in which the flint implements are well finished and smooth. In recent years there have been found in still older or Tertiary strata objects of flint in which the evidence of human workmanship is so slight that when Bourgeois, in 1867, first exhibited them as proof of the existence of man in the Tertiary period, he was simply laughed at.

Therefore, as Virchow has said, the question of the existence of the Tertiary man resolves itself into the problem of discriminating between natural and artificial forms of flint. The methods employed by these primitive toolmakers are also of general interest because, to the uninitiated, their selection of so hard a material as flint, and the possibility of working it at all with their crude appliances, must appear incomprehensible.

But, though flint is very hard, it is also very brittle. It is easily broken by striking or pressing, even with a much softer substance, and the resulting fragments possess sharp points and edges which make them suitable for use as spear heads and cutting tools in general. Glass, and the comparatively rare mineral obsidian, have properties much like those of the widely-distributed flint, and both, as we shall see, have been put to the same uses. In this way gunflints were made in quite modern times. A good workman, armed with an iron hammer, could turn out several hundred in a day.

But the diluvial and Tertiary men did not possess iron hammers. Their probable methods of working flint may be inferred from those of races whose stone age has continued to the present day. Such are the natives of Australia, Papua, Alaska, and Tierra del Fuego.

The Australian holds the flint between his feet and strikes it repeatedly in the same direction, but not violently, with another stone, obtaining sharp and slightly-curved splinters of various lengths, suitable for knives and arrow heads. Edward Krause, probably the highest authority on the subject, has seen and described the methods of both Alaskan and Fuegan toolmakers. The Fuegans preferred broken bottles as material, employing flint only on request and reluctantly, because it is harder to work than glass. The piece of glass was first rough-hewn to shape—with the assistance of the teeth in some cases—and then finished with the aid of a tool made of walrus bone. The Alaskan Eskimos use a tool made of reindeer horn, with a handle of fossil ivory, which abounds in Alaska. When great pressure is required the end of the handle is put to the shoulder.

Krause's explanation of the action, in both cases, is that the soft tool is first indented by the sharp edge of the flint or glass. Then, as the tool is moved along the edge with a constant outward pressure, a splinter is forced off. Krause himself succeeded in splitting glass with a tool of hard wood.

At the time of the Spanish conquest of Mexico, the Aztecs, who were still in their stone age, worked obsidian in a similar manner. Torquemada describes the process as follows: "The Indian cutler holds a piece of obsidian, about eight inches long and as thick as a man's leg, on the ground between his feet, or in tongs or a vise, and with hands and breast forces against it a stick of wood with a rounded end. The great pressure breaks the stone, yielding a sharp, pointed knife, the edge of which is the original edge of the stone."

We may assume that the men of the European stone age made their flint implements by methods similar to these. The implements bear characteristic marks of blows or pressure. On the inner surface of the splinter appears a slight, rounded elevation, the *bulbe de percussion*, and the surface of the flint nucleus, or remnant, shows a corresponding depression. The little nicks, or *retouches*, made by blows or pressure on the edges of the fragments are still more characteristic. The recent researches of Rutot, Krause, and Klaatsch have proved that these marks cannot be simulated by simple fractures or by the effects of heat, cold, or water.

Many exceedingly crude flint implements, called "eoliths," have been found in the oldest diluvial strata in Belgium, France, Germany, and Egypt. Rutot, Klaatsch, and Capitan have found numerous eoliths, also, in Tertiary strata in France and England.

In order to put the existence of the Tertiary man beyond all doubt Dr. Max Verworn has been making extensive explorations near Aurillac, in Auvergne, where Capitan and Klaatsch have recently worked with success. In a paper read before the Anthropological Society of Göttingen, on June 30, 1905, Dr. Verworn gave an account of his investigations, the complete report of which will shortly be published by the Royal Scientific Society of Göttingen, which financed the undertaking. The strata explored are defined as belonging to the upper Miocene, or lower Pliocene, by the occurrence in them of bones of the dinotherium and the hipparion (a progenitor of the horse). Of the many flints exhumed, from 16 to 30 per cent (in various localities) showed unquestionable marks of human workmanship, and only from 15 to 20 per cent were as certainly not worked.

The large proportion which remains as doubtful is explained by the fact that Verworn accepts only the combination of the face marks with the edge marks already mentioned as incontestable evidence of human workmanship.

Many of the pieces show the typical elevations on one face and depressions, or "negatives," on the other, with very numerous marks, parallel and made by blows in the same direction, on one edge or side, while the remaining edges are very sharp. Nuclei, or flints from which chips had been taken, were also found.

It appears, therefore, that there lived in Auvergne, at the end of the Miocene, a race of beings whose skill in toolmaking implies a period of development which carries the first approximation to humanity back to a far remote antiquity. No remains of these creatures have come down to us. We do not know whether they made use of clothing, fire, or articulate speech, whether they may fairly be regarded as men or only as the ancestors of men.

LITERATURE FOR CONVALESCENTS.

For reading during convalescence the British Medical Journal would prescribe literature that cheers but does not inebriate, and would contraindicate writers "whose style, like that of George Meredith, puts a constant strain on the understanding of the reader, or, like that of Mr. Maurice Hewlett, irritates by its artificial glitter, or, like that of Marie Corelli, annoys by its frothy impertinence." Dickens should go well during convalescence—except "Pickwick," at least in surgical cases, because of the many side-splitting episodes which would play havoc with the union of parts. And for the same reason, in order that healing granulations may not be interfered with, we would absolutely interdict Mark Twain. Smiles's "Self Help" is quite innocuous; but we should be cautious in recommending it, in order that the patient may not thereby be led to meditate over a misspent career, and to have suggested to him all the opportunities in life he might have grasped but did not. A despondency might thus be induced which would delay a restoration to health, and which might even prove fatal. Thackeray (except "Vanity Fair," which is a pessimistic book) should go very well; "Pendennis" and "Barry Lyndon" will certainly entertain. The magazines of the day are placid and cheering enough; and in them one will seldom come upon a story sufficiently original or vigorous to excite anybody. Punch will, of course, be always in order—for its humor is of the soothing sort, which never arouses one's risibilities, but keeps him always within the decorous limits of a smile.

TWENTY-FIVE ELECTRIC LOCOMOTIVES FOR N. Y., N. H., AND H. R. R. CO.

An order for twenty-five electric lomotives has been placed with the Westinghouse Electric and Machine Company by the New York, New Haven & Hartford Railroad. These will be driven by alternating current, single phase. Each locomotive is to weigh 78 tons, and is to be equipped with four motors, each of 400 horse-power, making a total of 1,600 horse-power for each locomotive. This is 600 horse-power greater than steam locomotives in present use.

The motors will be able to maintain a speed of 26 miles an hour in local service, reaching a maximum speed of 45 miles an hour between stations, and hauling 200 tons. In express service a speed of 60 to 70 miles an hour can be maintained with a train weighing 250 tons.

SCIENCE NOTES.

A boiler furnace, as is known, works best when as little heat as possible escapes through the chimney. To some extent, says Technische Berichte, this escape is unavoidable, for if all the heat were utilized, the chimney would not draw, since it is the heat in the chimney which first produces the draft in the furnace necessary for burning the fuel. Nevertheless, too much heat escapes by the chimney in most cases. A patent recently granted professes to rectify this defect by bringing the flue containing the products of combustion to the place where the steam is applied before it passes into the chimney. The air, steam, or hot water and feed pipes are passed through this flue, so that the heat contained in the gases of combustion prevents radiation from the pipes in question and contributes to the heating of the air, water, and steam.

There are interesting and suggestive symptoms of a wholesome reaction against the evils of the sedentary life. Parks and open spaces are being liberally provided; public and private gymnasiums are rapidly coming into being; public playgrounds are thrown open in many of our cities, free of expense to the laboring, but, nevertheless, often sedentary, population; vacations are more than ever the fashion; sports and games are everywhere receiving increasing attention; while public baths and other devices for the promotion of personal hygiene are more and more coming into being. All this is as it should be, but all is as yet only a beginning. Here the science of educational reform is sadly at fault, and in the direction of educational reform as regards personal hygiene lies immense opportunity for a contribution to public health science.

The growing of grapes in graperies furnishes quite a source of revenue in some countries, notably Belgium and the Channel Islands, where large quantities are annually grown and exported, the United States being a good customer for them, as high as 35 cents to 75 cents per pound wholesale, and \$2 to \$3 and even more per pound retail, being paid for the fruit. Grape growing in pots is much practised and in parts of Europe, and especially in France, where these are largely used for decorative purposes on festive occasions. The keeping of grapes in cool storage is deserving of more extensive practice and development. Shipping and keeping grapes in cork dust is quite an industry in some of the European grape districts, and a considerable quantity of such grapes, shipped from Spain, is annually consumed in this country.

If electric phenomena are different from gravitative or thermal or luminous phenomena it does not follow that electricity is miraculous or that it is a substance. We know pretty thoroughly what to expect from it, for it is as quantitatively related to mechanical and thermal and luminous phenomena as they are to each other; so if they are conditions of matter, the presumption would be strongly in favor of electricity being a condition or property of matter, and the question, "What is electricity?" would then be answered in a way by saying so, but such an answer would not be the answer apparently expected to the question. To say it was a property of matter would be not much more intelligible than to say the same of gravitation. At best it would add another property to the list of properties we already credit it with, as elasticity, attraction and so on. In any case the nature of electricity remains to be discovered and stated in terms common to other forms of phenomena, and it is to be hoped that long before this new century shall have been completed, mankind will be able to form as adequate an idea of electricity as it now has of heat.

THE CURRENT SUPPLEMENT.

The current Supplement, No. 1556, opens with a splendidly-illustrated article on a vertical rolling-mill 18,000-horse-power engine, the largest of its kind that has ever been built. Among the many means that contribute to the evolution and better performance of machines, and that determine their endurance and economy of construction, there is one, sometimes ignored and in all cases underrated—the phenomena of their operation, which are not computable or learned by rule. This subject has been very interestingly treated in a paper by Mr. John Richards. A protected galvanometer is described and illustrated. Mr. J. H. Morrison's history of the iron and steel hull vessels of the United States is continued, the period of 1840 to 1860 being discussed. Mr. H. Percy Ashley tells how an improved ice yacht may be constructed. His article is accompanied by elaborate working drawings. Sir William H. White's sixth paper on submarines is presented. "How Our Senses Deceive Us," is the title of an article by Dr. Horace Wilson, in which many a curious bit of information is given. Prof. Richter writes entertainingly on the inhabitants of a piece of moss. Dr. Hugo de Vries, the man who gave us the mutation theory of the origin of species, a theory which is very likely to supplant that which has been advanced by Darwin, writes on the evidence of evolution in a way that cannot but impress even the reader who is not particularly interested in biology.

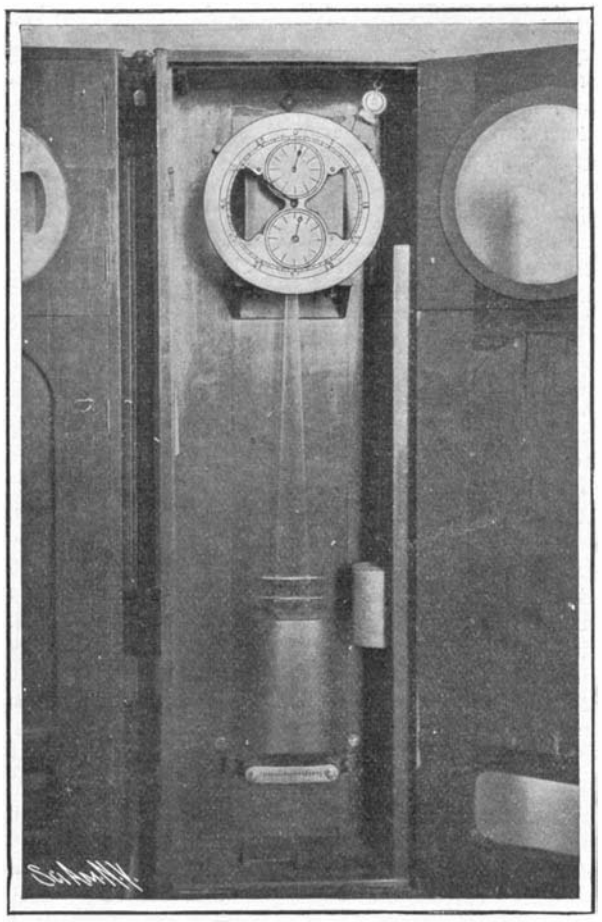
"THE TIME OF DAY."

BY DAY ALLEN WILLEY.

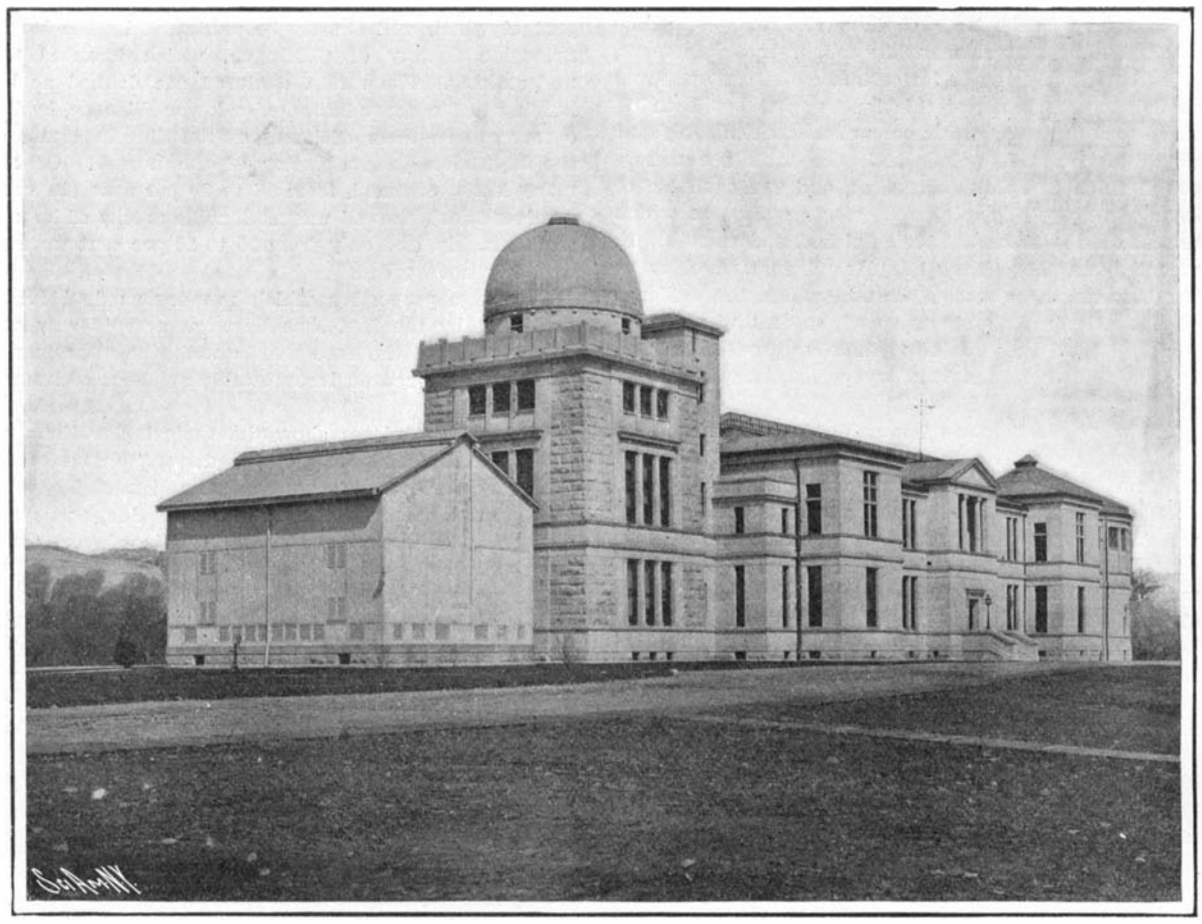
If asked what is the real meaning of the expression "time of day," a person may reply that it is determined by the position of the sun in the heavens. For example, we speak of "noon" as the time when the sun is at the meridian point. The fact is, however, that no longer is the time standard in this country calculated by the sun, but by the stars, and the time signals sent daily throughout the United States from Washington come from star observation.

Americans get their correct time from a little room in the Naval Observatory, located on Georgetown Heights, in the suburbs of Washington. The observatory was originally intended to detect errors in ship chronometers and to regulate them properly. This work constitutes one department at the institution, but perhaps its most important function is that of being hour, minute, and second as determined by the stars are shorter than those of the sun as recorded by the clocks; and consequently the time of the "star clock"—which is corrected directly from the stars by means of the transit—must be translated into solar time, before it is available in the readjustment of ordinary timepieces.

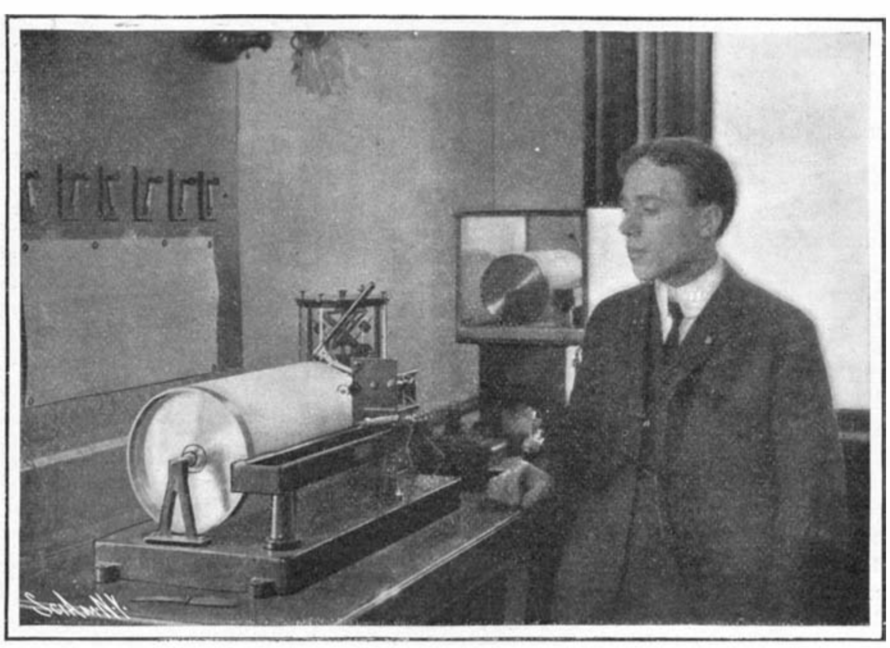
In his observation of the star utilized for a time basis, the astronomer has the aid of the nautical almanac. By consulting the almanac an observer learns just when the star under observation should cross the meridian. Taking his place under the transit, he awaits the scheduled passage of the star. Precisely as the latter crosses the imaginary line, the observer presses a telegraph key, and the exact time of passage is accurately registered by the chronograph. This instrument, which has been described in the Scientific American, furnishes a record of any error in the device is made to revolve at a fixed speed. Behind the dial in each signal clock marking the seconds is a cogged wheel, each cog of which in turn touches a brass spring, thereby closing the circuit of a battery, and by a mechanical arrangement causing the pen above mentioned to make a horizontal mark on the paper enveloping the cylinder. This affords a permanent record of each second. The star clock is also in circuit with the recording pen. A cup of mercury resting in the clock is connected with one pole of the battery. The pendulum is connected with the other. As the latter swings, it touches the mercury in the cup, closing the circuit and sending an electric impulse which causes the pen to do its work. It is comparatively easy to set one of the ordinary clocks within a second of the star clock; but an adjustment of a fraction of a second requires measurements of great nicety. Corrections are made a comparatively short



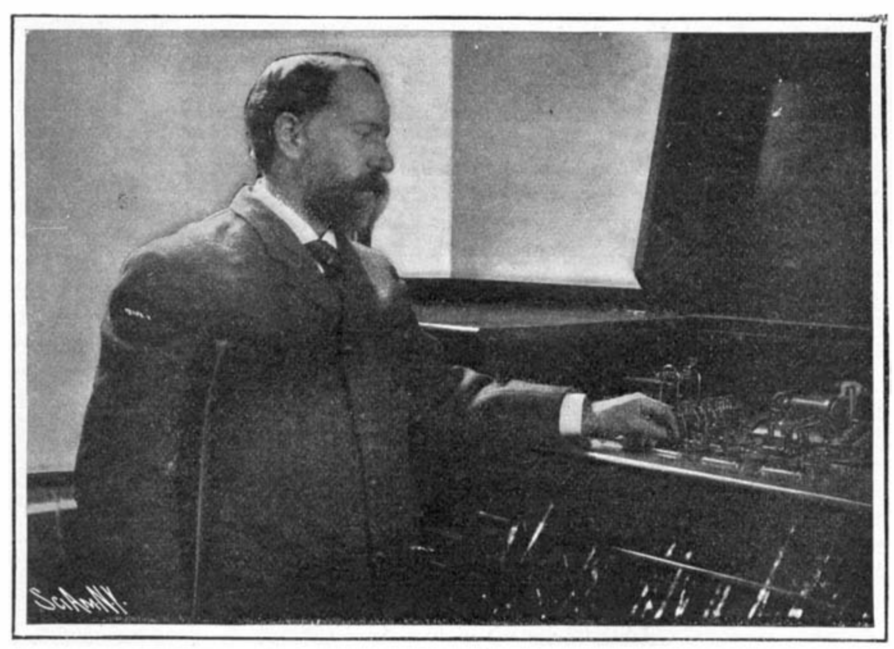
Master Clock from Which Noon Signal is Sent Throughout the United States.



The Naval Observatory, Where the Nation's Time is Kept.



Chronograph for Noting Any Inaccuracies of Clocks on the Circuit.



Sending the Correct Time to All Clocks and Time Balls at the Hour of Noon.

"THE TIME OF DAY."

the nation's timekeeper as well. Consequently some of the most important instruments installed in the group of buildings comprising the observatory are intended exclusively for this purpose.

Among these are the 9-inch and 6-inch transit instruments by which the position of a star is obtained. The actual elapsed time required for one revolution of the earth on its axis can be accurately determined only by measuring the interval between two passages of a given star across a designated meridian of the earth—intervals which do not vary from century to century. This, then, becomes the basis of time determination. It is, however, a foundation not secured without considerable effort, for the number of revolutions which the earth actually makes on its axis is one greater than the number of so-called solar days in the year, as prescribed by the calendar in common use. Accordingly, the day, time of the star clock by which the latter can be regulated to the minute fraction of a second, for the accuracy of the clock can be calculated by the space between what may be called the observer's second as recorded on the chronograph and the clock second nearest it. By measuring the space with microscopical gages, the correct time can be determined to the minute fraction of a second, and the standard clock set accordingly.

With the star clock adjusted, the next proceeding is to set the signal clock in unison with it. From the signal clock, which is placed in the same room, comes the time announcement, which is sent over the country. There are two signal clocks, one being held in reserve in case of accident. Both are on a circuit with the star clock. When they are to be adjusted by the latter, the paper-covered cylinder of the recording time before noon, so that there will be little opportunity for the clocks to gain or lose before the time at which the all-important signal is transmitted.

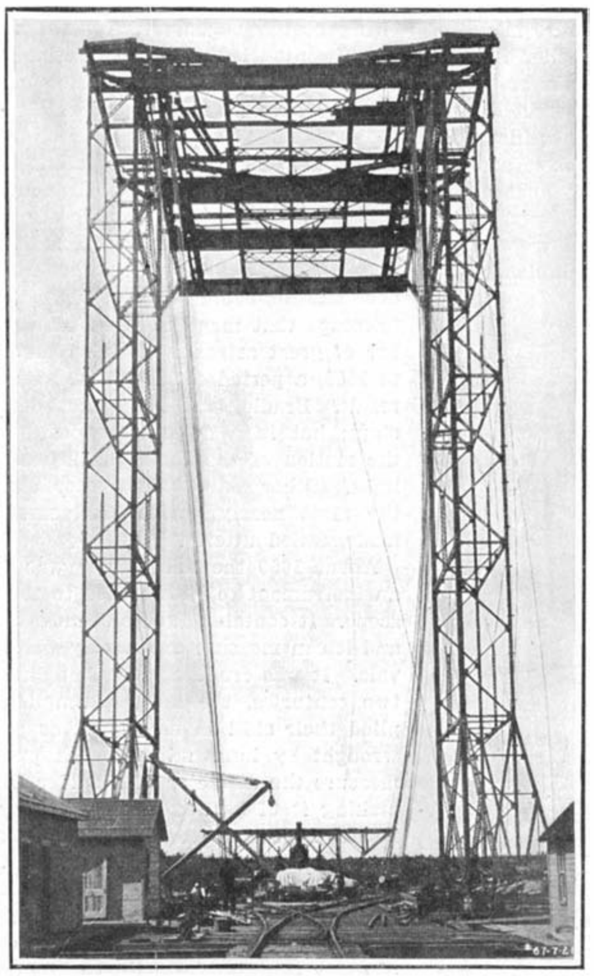
At three and a quarter minutes before noon, the signal clock is connected with the telegraph circuit, which covers the entire country; and from that moment until the sending of the signal, all business is suspended throughout the telegraph systems over which it is to be flashed. Warnings of the approach of the time signal precede by short intervals the actual announcement of the noon hour. These warnings are in part sent automatically. The signal clock is fitted with a toothed wheel, which is located directly behind the wheel that marks the seconds, and which is divided into sixty spaces corresponding to the seconds in a minute. At the twenty-ninth second, however, the tooth is missing; also those representing the fifty-fifth to the fifty-ninth

second respectively. As the wheel revolves, the teeth come in contact with a spring, which is in connection with the electric current, closing the circuit and causing the sounder to respond. The absence of the twenty-ninth tooth causes the twenty-ninth signal to be omitted, and indicates the approach of a half minute; that of the last five announces the approaching conclusion of the minute. All this takes place in the next to the last minute of the final hour. There is a third warning interval of twenty seconds before the supreme signal; but this is produced not automatically but by the telegraph operator at the observatory, and occurs when he moves the switch key, which throws out of the circuit the wheel marking the seconds, and throws into the circuit the wheel marking the minutes.

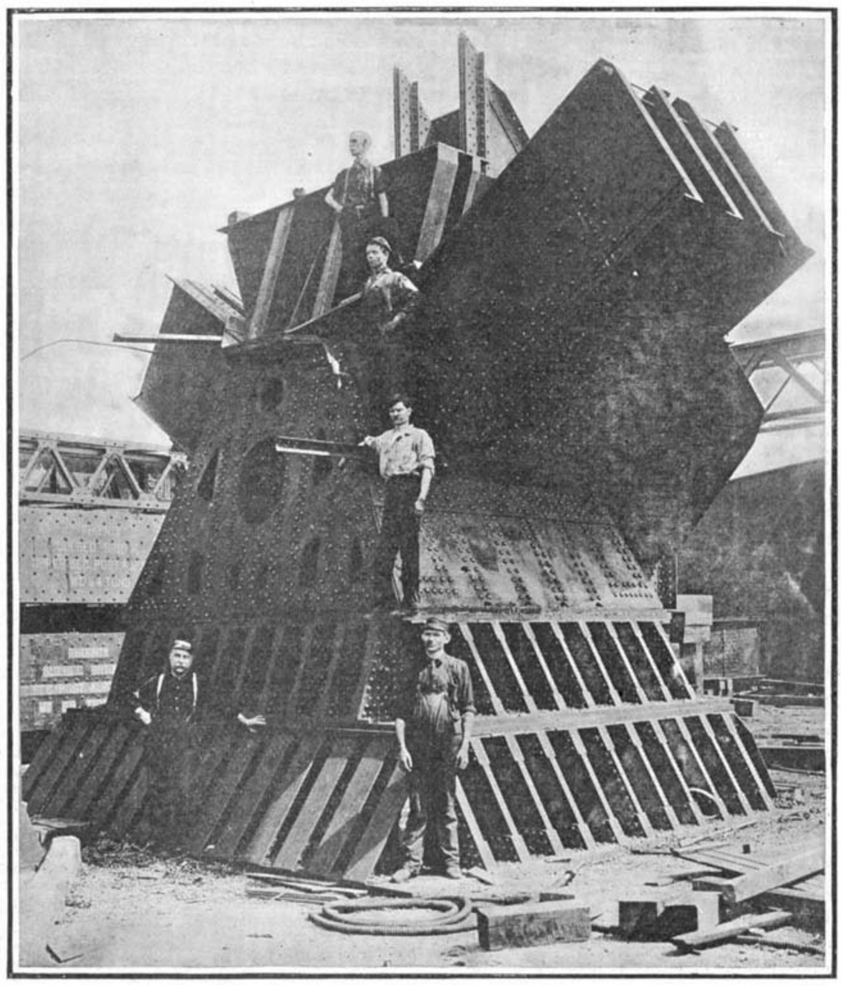
In the final hundredth of the last second of the last hour at Washington, the tooth of the minute wheel touches the spring which closes the circuit. Simultaneously, the announcement is flashed to every part of the country, the flow of the current serving of itself to release the time-balls which have been hoisted to the tops of the staffs in various cities. How rapidly the signal travels may be appreciated from the fact that it is flashed from Washington to San Francisco in one-fifth of a second. Since the time signal is sent out from Washington at noon, or at 12 o'clock standard Eastern time, and there are four different standard times in the United States, determined by geographical locations, the signal from Washington will reach the Central, Mountain, and Pacific time belts at 11 o'clock, 10 o'clock, and 9 o'clock A. M. respectively. On the last night of the year, the time signal—which in this instance marks the advent of the New Year—is sent entirely around the world, traveling over 1,180,000 miles of wire and cables, and making the circuit of the globe in ten seconds.

At present about 75,000 clocks are on the wires connected with the signal clock, but as in some instances one of these is utilized to regulate hundreds of other timepieces, the time standard as computed at the observatory is now depended upon in the principal communities throughout the country.

In addition to the instruments referred to, the Naval Observatory is also notable for the reason that it contains what is considered to be the finest telescope in the United States—with the exception of the Lick, in California, and that in the University of Chicago. It has a 26-inch glass and cost $46,000.



End View of Main Traveler for Erecting the Bridge.
Width, 100 feet. Height, 215 feet. Over-reach, 66 feet.



One of the Four Pedestals and Main Shoes Which Carry the Whole Weight of the Bridge. Weight 278 Tons.

THE ST. LAWRENCE RIVER BRIDGE, QUEBEC.

The noble bridge now under construction at Quebec across the St. Lawrence River will be one of the most notable bridges in the world. In one respect indeed it will rank as the greatest structure of its kind ever constructed; for its main span across the river will have a total length in the clear, between towers, of 1,800 feet, which is exactly 90 feet more than the length in the clear of each of the two cantilever spans of the bridge across the Forth, near Edinburgh, Scotland.

The bridge is being built by the Phœnix Bridge Company for the Quebec Bridge and Railway Company. It will cross the St. Lawrence River at a point about six miles above the city of Quebec, and about 165 miles below the city of Montreal. In the intervening stretch of the St. Lawrence there is no other crossing, and the great width of the river below Quebec renders the bridging of it below that city out of the question. Hence the new thoroughfare will prove of the greatest benefit to the districts lying between Montreal and the sea. Apart from its convenience for foot passenger and vehicular traffic, which must necessarily be local, it will form an invaluable link between the important railway systems on each side of the river. On the north side are the Great Northern Railway of Canada, the Quebec & Lake St. John Railroad, and the Canadian Pacific; on the south side are the Grand Trunk Railroad, the Intercolonial Railroad, and the Quebec Railway; and immediately upon the completion of the bridge a transfer of business between these systems will become possible.

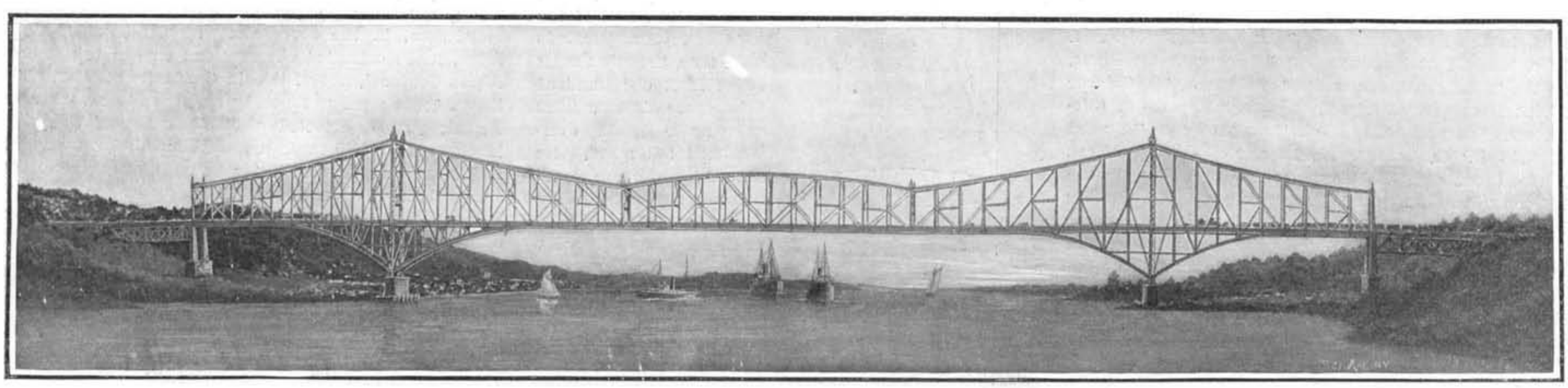
The depth of the river, and the necessity for keeping this great waterway free from obstructions, prevent the use of piers, and call for bridging the channel with a single span. A comparative study of the problem showed that even for a span of this magnitude, a cantilever would be more economical than a suspension bridge, and the plans herewith shown were adopted.

The structure consists essentially of two giant cantilevers, carrying a huge central suspended span. It is approached by two short deck spans. The latter, which are each 214 feet in length, extend from the shore to the two massive anchor piers, to which the anchor arms of the cantilevers are bolted down, and which serve to counterbalance the weight of the central suspended span, and the heavy live load which it will be called upon to carry. The anchor arms are 500 feet long, the river arms 562½ feet long, and the central suspended span is 675 feet long. The height of the cantilevers over the anchor piers is 96 feet 9¾ inches, at the towers 315 feet, and at the portals to the center span, 97 feet 5½ inches.

The bridge has a very large capacity, the floor having a total width, out to out, of 75 feet. It is designed to carry two lines of steam railroad, two trolley lines, two highways, and two sidewalks, the latter being placed outside and the rest of the traffic between the trusses, which are spaced 67 feet between centers. The clear headway above high water is 150 feet.

In a bridge of this magnitude the parts are necessarily of great size, and the huge proportions are well shown in the accompanying illustration of the main shoe and pedestals, which are placed upon the main piers and have to carry the whole load of the bridge. They are of built-up rolled steel girders, not a single casting being used in the completed structure. The weight of each one is 278 tons. As might be expected, the size of the individual members is enormous, the sections of the bottom of the main post being 54 feet in length, 10 feet in width and 4 feet in depth, and the weight of each piece being 70 tons; while the intermediate sections of the main post weigh 24 tons, have a length of 66 feet, and a section measuring 10 feet by 4 feet. The I-bars for the most part are 15 inches and 16 inches in depth, and in a few cases they will be as much as 18 inches in depth. Most of the pins are 12 inches in diameter; but the main lower pins, which will transmit the enormous load from the cantilever to the shoes above mentioned, are 24 inches in diameter. The main chords are 54 inches deep by 68 inches wide, while the main post, over the river pier, is 10 feet wide by 4 feet in depth. The main plate floor beams are 10 feet in depth.

The bridge is being erected by means of the huge main traveler, shown in the accompanying illustration,



River span, 1,800 feet. Two anchor spans, 500 feet each. Two shore spans, 214 feet. Total length, 3,228 feet. Height of towers, 315 feet. Suspended span, 675 feet long by 130 feet deep. Width of bridge, 75 feet.

This Bridge, Now Building at Quebec, Will Have the Longest Single Span in the World.

THE NEW ST. LAWRENCE RIVER BRIDGE.

which is 100 feet in width by 215 feet in height, and has an over-reach of 66 feet. The traveler is served by four electric hoists, and it can handle the heaviest sections, which weigh as high as 105 tons. The material for the bridge is placed in a storage yard near the end of the structure, which is 750 feet in length and is served by two 70-foot electric cranes.

A Few Facts About the International Exposition, Milan, Italy.

In order appropriately to celebrate the completion of the Simplon tunnel—one of the greatest triumphs of engineering—an international exposition under royal patronage will be held in Milan from May to November, 1906. It will be the largest European exposition ever held outside of Paris. Practically all of the European countries will participate officially, as well as several of the Asiatic nations.

In the transportation section, retrospective exhibits will show the historical development of the various methods of travel.

The dominant feature will be motion. All products, as far as possible, must be shown in connection with the processes, thus filling the halls with live exhibits.

Arrangements will be made for field tests and competitive trials in all classes where it is expedient.

An especial feature will be the automobile display, to which an entire pavilion will be devoted. This "show" will terminate in mid-summer, so that machines exhibited may be sold for early delivery.

The great success that attended the Turin exhibition of decorations has prompted the Milan authorities to set aside a special pavilion for decorative arts. They are very desirous to see the United States well represented in the section.

One large building will contain all forms of welfare work, grouped under the several heads: Mutual assistance and insurance, co-operation, savings institutions and popular credit, protection of labor and insurance against enforced idleness.

Milan is the center of the most productive section of Italy. Its population is one and a half millions, while Lombardy, no part of which is more than three hours distant, has nearly five million inhabitants.

Genoa, the port of entry, is less than one hundred miles distant. The cost, therefore, of transporting exhibits from the United States will be comparatively cheap.

Owing to the fact that a large proportion of the labor is employed in the shops and factories, there is available only a small number of food-producing workmen. This makes it imperative that supplies be secured from abroad. The authorities of the exposition recognizing this condition will inaugurate about June 15 a special food show. It will be well for the American producers of food stuffs to profit by the opportunity to display their products.

A Balloon Race.

The long-distance balloon race which started October 15 from the gardens of the Tuileries has resulted so far as known as follows:

Boulanger in the balloon "Eden" landed on October 16 at 1:40 o'clock at Annaberg, Germany, a distance of 810 kilometers from Paris. David in the balloon "Cambronne" landed at Platting on the Austrian frontier, 780 kilometers, at 7 o'clock A. M. Maison in the balloon "Concorde" landed at Neustadtsalle, Bavaria, at midnight, 610 kilometers.

Erik Tollander de Balsch, in the balloon "Finland," landed at midnight at Metz, 282 kilometers. Bachelard, in the balloon "Phoebe," landed at 10:30 P. M. in a tempest at Engreux, 290 kilometers. Le Blanc, in the "Albatross," landed at 1 o'clock A. M., October 16, at Densborn, Germany, in a snowstorm, 340 kilometers. Oultremont, in the balloon "Belgique," landed at 9:15 P. M., October 15, in a violent tempest, at Kirin, Oldenburg, 398 kilometers. Von Willer, in the balloon "Centaure," landed at 3 o'clock P. M., October 15, in a tempest at Darmstadt, 480 kilometers.

Gasnier, in the "Eole," arrived at 9 o'clock A. M., October 16, at Rulles, Luxembourg; Blanchet, in the "Archimède," at 9 o'clock at Beaufort, Luxembourg; Duprat, in the "Belle Hèléne," on the Belgian frontier, in a terrific snowstorm; Balzon, in the "Académie Aeronautique," at 7:20 A. M., October 16, near Vouziers; Jacques Faure, in the "Kabylie," at 10:30 A. M., October 16, at Kirchdorf, Hungary.

An Economy Test for American Automobiles.

On October 30 the New York Motor Club will start a six-day economy test. Runs will be made to Philadelphia, Albany, and Southampton, L. I. Strict account will be kept of all fuel and oil used and repairs made, and the results will show the cost of transportation per passenger per mile as compared with the railroad fares. No allowance will be made for repairs to tires, which will also figure in the general expenses. It is expected that some twenty cars will participate in the test, and that much interesting and valuable data will be obtained.

MEASURING THE DISTANCE OF A STAR.

BY PROF. EDGAR L. LARKIN.

No conception whatever can be had of the magnitude of the visible universe until the distances of the stars are known. None of the millions of human beings that have lived and died knew the distance of even one star from the earth until within the last seventy years. To all who lived before the advent of modern astronomy, the stars were points in a rigid firmament, only a short distance "above" the earth. They were made to give light to the earth's inhabitants, a belief incredible to relate, still lingering in the minds of some. Before A. D. 1542, ignorance was at its lowest depth. But in that auspicious year Copernicus gave his book to the world teaching that the earth revolves around the sun. Of course the people raised strenuous opposition. This was expected. But unrest and perplexity filled at least one of the ablest minds in Europe, that of Tycho. From the days of Aristotle and Ptolemy, the theory that the sun revolves around the earth dominated men's minds. Not one law could be discovered so long as it was believed that the earth is the center of the universe and at rest. Copernicus upset this doctrine, and made the sun the center of planetary motion. The great Tycho Brahe actually rejected this basic truth of nature. His mathematical powers must have told him that Copernicus was right in asserting that the earth moves around the sun. But when he saw that if this is true, the entire orbit traversed by the earth around the sun, that mighty ellipse, shrinks and subsides into nothingness, his mind was simply submerged by the immensity of the idea, and all it led to. For twenty years he toiled in an observatory making measurements with every accuracy possible without telescopic aid. And he failed to detect the slightest displacement of any star throughout the year. For it is certain that if the earth moves around the sun, the stars in position at right angles to the plane of the orbit must shift to and fro at intervals of six months corresponding with the displacement of the earth from side to side of its majestic pathway. So he taught that the earth is at rest. He could not force himself to admit that the diameter of the orbit of the earth as seen from any star is next to nothing, and that the earth is next to next to nothing, and man an infinitesimal so minute that no combination of figures is able to tell how small he is. Tycho could measure four minutes of arc with some approach to accuracy; still he could not detect the slightest displacement of a star. He at once knew that the stars were not less than one thousand times farther away than the sun. Saturn at that time was the known limit of the solar system, and if the hypothesis of Copernicus were true, the stars must be at least one hundred times more distant. This vast space again overwhelmed his mind. He argued that Nature would not so waste space. But Copernicus advanced arguments that Tycho could not overthrow, so Tycho compromised. He made the five planets revolve around the sun, and the sun around the earth, immovable in the center of the universe. At that epoch, it is probable that if Tycho had an instrument capable of measuring one second of arc and had he tested it on any star, the Copernican system would have been crushed. For he would have discovered that the stars do not shift even one second in six months. For with an annual shifting of one second of arc the star in question would have been known by Tycho to be 206,265 times more distant than the sun. Medieval minds would have collapsed and an indefinable fear would have settled down on mankind, when thinking of its littleness.

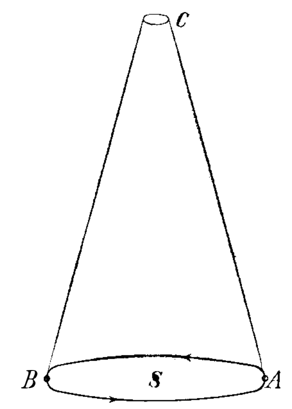
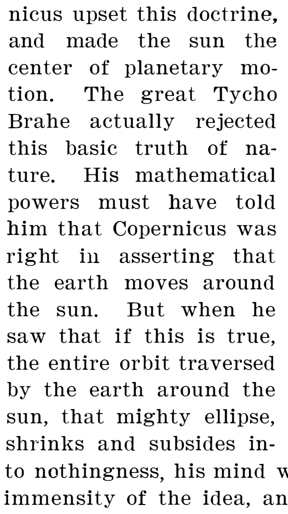


Fig. 1.—S is the sun. A is the earth's place on its orbit to-day; and B its position six months later. The arrows on the orbit of the earth show the direction of its motion. C is a very minute orbit apparently traversed by a star once each year. It took 230 years from the date of invention of the telescope to detect and measure it.



Bessel's Method of Finding the Distance of a Star.

Fig. 2.—Showing the sun S, in the center of the earth's orbit, and places of the earth at intervals of six months, at A and B. C is a star whose distance is sought. D and E are two stars, presumably so much more distant than C, that they cannot show displacement as the earth moves from A to B. The angles E, D and C, and the lengths of the lines ED, CD and EC, are often measured with precision. In this way Bessel found the shifting and thereby the distance of 61 Cygni. The reader will understand that all the angles in Fig. 2 are immensely exaggerated. All the early astronomers thought that two lines drawn to a star from opposite sides of the earth's orbit were parallel as are the two lines F and G. And more than two centuries in incessant toil were consumed in finding that they are not exactly parallel. For the line AB, 186,000,000 miles in length, is next to nothing.

Matters moved on apace. Tycho died, and the Copernican doctrine spread. Then came Galileo with his little telescope, and pointed it full on the distant stars in A. D. 1610. This aroused Europe, and the exciting search began. Astronomers now armed with instruments that magnified were able to detect far less displacements of stars than could be detected by Tycho. And they began to watch. Thus they noted the position of a star, its direction in space and its distance from other nearby stars and recorded these determinations. In six months they repeated the process with great care. They were dumbfounded. Although the earth had moved from its first place, by the diameter of its mighty orbit, no trace of motion, however minute, could be detected in the stars, even in a telescope that magnified two hundred times. A number of great astronomers tried their hands from 1542 to 1650, a period of 108 years, with total failure as a result. Bradley and Molyneaux detected a motion of stars; but in a direction opposite to any caused by the motion of the earth. This was the aberration of light. Other astronomers after elaborate trials with the most nearly perfect instruments that could be made, failed utterly.

About 1650 the micrometer was invented. This is an instrument to be attached to the eye-end of a telescope. It contains fixed and movable spider's threads, and it can measure excessively small angles and intervals. It was crude at first, but during the succeeding two centuries, the most accomplished mechanics applied their skill in making it as perfect as anything wrought by human hands. At present it is able to measure the diameter of a spider line. The object of making it of such extreme accuracy is to be able to measure the diameter of the earth's orbit as seen from the stars. For next to nothing is the diameter seen from stellar distances.

Passing the labors of the Herschels and the Struves and many other eminent astronomers, who made use of every conceivable method of finding the distance of a star, we descend rapidly to Bessel and Henderson, two illustrious observers, who finally succeeded, and reaped the reward of two centuries of labors surpassing those of Hercules. Bessel, at last, in 1840, found the distance of the star 61 Cygni. He used a different kind of telescope, the heliometer with a divided object glass. He employed the method known as triangulation. He selected two stars adjacent to 61 Cygni and measured a network of triangles, whose sides were the distances from star to star and from each star to 61 Cygni. He repeatedly measured these angles from October, 1837, to March, 1840, and had the extreme good fortune to see 61 Cygni move. And the direction of motion was as it should be, if caused by the annual circuit of the earth. He found that if we go to 61 Cygni, turn and look this way with a powerful telescope and micrometer, the distance of the earth from the sun would measure 0.3483 second of arc. The arc of any circle in length equal to the radius contains 206,265 seconds, which divided by 0.3483 equals 590,000. That is, the star is at the colossal distance of 590,000 times that of the sun. To reduce this to miles, multiply by 93 million. The result is so enormous that the ablest mathematicians never try to begin to think about it. Light, known to move with the unthinkable speed of 186,000 miles during one second of time, requires nine years to traverse the abyss. Before this work of Bessel, Henderson, in the observatory at the Cape of Good Hope, made extended observations on the bright star Alpha Centauri, not visible in the United States. His instruments were not nearly so accurate as those of Bessel; yet he detected a displacement of the star. Maclear in 1839-40 made more accurate measurements, and later observers with far better instruments have finally deduced a parallax of 0.75 second of arc. Parallax means the angle subtended by the radius of the earth's orbit as seen from a star. Now 206,265 divided by 0.75 equals 275,020, the number of times that Alpha Centauri is more distant than the sun. This is 25 trillion miles; and that star is our nearest neighbor, so far as is known. Light requires 4.3572 years to reach us from the nearest neighbor our sun has. But there are so many stars whose distances are so much greater than these two, that the 25 trillion miles is used merely as a yard-stick to measure them. Of late, these minute displacements of stars are measured on photographic plates after long exposure to the stars. Great attention is paid to parallax determinations, for without them we must forever remain ignorant of even approximate dimensions of the sidereal structure. Some astronomers think that so great precision is now had, that parallaxes of 0.1 second of arc are obtained. And perhaps fifty stars are measured with this degree of accuracy. A star with one-tenth of a second parallax is 2,062,650 times more remote than the sun. These are "near-by stars," for there are millions of stars so distant that no instrument, however

accurate, can ever hope to secure a parallax. It is time now to put in the term "next to nothing" again for all things terrestrial. That is, the thickness of a spider thread would obscure the entire orbit of the earth in its mighty sweep around the sun, as seen from the distant stars. And all agree that a spider line is next to nothing, so the astronomer Tycho rejected the true order of Nature simply because of its mind-crushing magnitude and splendor. He had not the fortitude to admit the infinitesimal dimensions of the earth and man. All kinds of estimates have been made as to the probable radius of that part of the universe visible in the greatest telescope. Opinions vary between the limits of 4,000 to 15,000 light years. That is, with a radius of 15,000, the diameter would be so immense that light would require 30,000 years to traverse it. The opinion of the writer is for the 30,000 yet no positive proof is possible. This opinion is based on photometric grounds. The word millions has for long been used in telling the number of the stars. But billions now appears to be more appropriate. Each one is a hot sun, and each may be attended in many cases by inhabited worlds.

The Best Cat Story Yet.

BY DR. JOHN NICOL.

Without attempting to decide as between heredity, imitation, or reasoning, or what part each or all or any of them played in enabling the cat to perform the feat of which I am about to tell; merely premising that I can vouch for its truth, as can many others who had frequently seen it done.

The cat belonged to my brother-in-law, the owner of Hazeldell farm, near Ulster, Pa., and that it might go out and in at its own sweet will, the usual cat-hole was cut in the door between the kitchen and the wood-shed. Besides the cat referred to, which may be called the house cat, there were several others who remained mostly in one or other of the barns and were not encouraged to enter the house, although shortly before the time of which I am about to speak they began to come in more than the mistress cared for.

To prevent this, a swing door was placed on the outside over the cat-hole. It was simply a piece of board a little larger than the hole, and fastened by leather hinges at the top, so that by pushing her head against it from the inside the cat could get out, but could not by such pushing get in again.

For a time the cat did not appear to understand the new arrangement, but "meoued" persistently each time she wanted to go out, till some one taking her in his hands and pushing her head against the door showed her what to do, and *she did it herself ever afterward.*

This went on for some time, always getting out herself, but always calling loudly whenever she wanted to get in, till the letting of her in began to be considered a trouble, and she was often allowed to call in vain. Just how long this continued I do not know, but it did cease, and the cessation of one trouble threatened to bring about another. The cat was found in the house when those whose duty it was to put her out and not let her in again asserted that they had been true to their trust. This was "by some believed and some misdoubted," and, like other trifles, was likely to bring trouble in the household, when those that blamed the cat were found to be more correct than the cat blamers generally are; *the cat had discovered a method of opening the door for herself.*

The accused member of the family, strong in the justice of her cause, determined to watch, and this is what she saw: The cat, on coming to the door, lay down on her back, and with both her front paws raised the hinged board considerably above the level, and then, with what I cannot find a better expression for than a wriggle, rapidly turned on her belly and drew her body inside.

I may add that this was seen not once but perhaps hundreds of times, as it got to be one of the show things at the farm, the cat not being in the least shy, but always ready to perform the feat in the presence of visitors.

While heredity can have had nothing to do with this operation, I may take the opportunity of recording another in which heredity alone was the active agent. It is well known that Manx cats have no tails, only slight stumps, and that the offspring of such in other parts of the world, in the first generation at least, are in the same abnormal condition. While living in Scotland some thirty years ago we had a Manx kitten given to us, which, although born there, was tailless. The door of our breakfast room was spring-shutting, something like most of the screen doors in this country, but opening only toward the inside. Before the kitten was full grown he had learned to let himself in by pushing from the outside, but never learned, although we often tried to teach him, to pull it open from the inside. It was not, however, the opening of the door from the outside to which I wish to call attention—any cat could have easily learned to do that; but the fact that invariably, after he had so pushed it and got his body partially in, he made a rapid turn or whirl to prevent the tail that was not there (but heredity impressed on him the fact that it ought to have been) from being caught between the closing door and its frame. This he did dozens of times every day so long as we had him, and was always willing to show off before our visitors, as he never seemed to recognize the fact that he had not a tail like his neighbors.

Correspondence.

The New Process of Resuscitation Proves to Be Old.

To the Editor of the Scientific American:

I notice in the Scientific American for October 7, 1905, an article entitled "A Novel Process of Reanimation."

It might be interesting to you to know that there is in the Proceedings of the American Association for the Advancement of Science a record of an address by Dr. Alexander Graham Bell, presenting over twenty years ago an idea substantially the same as that of Dr. Gradenwitz. I beg to quote an abstract taken from the thirty-first meeting of the above-named society, held at Montreal, Canada, August 1, 1882:

"I propose to surround the waist of the unconscious patient by a rigid jacket or drum somewhat larger in diameter than his body. The apparatus can be rendered practically airtight by a rubber band around the thorax, and another around the loins. Upon exhausting the air inside the drum, a partial vacuum is produced around the abdomen. Under such circumstances, the pressure of the atmosphere forces air through the mouth and nose into the thorax, causing the depression of the diaphragm and consequent expansion of the abdomen. The alternate rarefaction and condensation of the air confined around the abdomen thus cause alternate inspiration and expiration."

Charles R. Cox.

Volta Bureau, Washington, D. C., October 15, 1905.

Old Things Forgotten in These Progressive Days.

To the Editor of the Scientific American:

It is surprising to an oldish man how many things of daily use the present generation seems to have forgotten.

Here are some instances.

1. To tell the points of the compass by a watch.—Point the hour-hand at the sun. Then south is halfway between the hour-hand and the figure twelve of the dial.

2. To measure an angle by a watch.—Lay two straight-edged pieces of paper on the angle, crossing at the apex. Holding them by where they overlap, lay them on the face of the watch with the apex at the center. Read the angle by the minutes of the dial, each minute being six degrees of arc. It is easy to measure within two or three degrees in this way.

3. To start a tight screw.—Press the screwdriver firmly in place with one hand, but do not turn it. Then take hold of it sideways with flat-jawed pliers as close to the head of the screw as possible, and turn it with them. A hand vise is better than pliers. Leave just enough of the tip of the screwdriver outside the vise to fill the slot of the screw, but no more. This reduces the danger of breaking or bending a badly-tempered screwdriver to a minimum.

4. To put a pin through starched linen, rub the pin with paraffine. To push a collar button through a starched buttonhole, rub paraffine on the back of the buttonhole. Jacob Bromfield.

Boston, September 23, 1905.

The Reasoning Power of Animals.

To the Editor of the Scientific American:

I read your valuable paper weekly with much interest and profit. The several articles that have appeared recently therein on the subject, "Do Animals Reason?" have deeply interested me; and the facts stated so strongly appeal to my love for justice for animals that many abuse and underrate, as well as my love for them, that I desire to repeat a single instance, one of many, showing the rapid reasoning and quick action by one, and the intelligent confidence displayed by another animal in my presence—a dog and a horse.

I was the possessor of a bright, active Irish setter dog, "Laddie," who accompanied me on my many drives through the country. My dog and horse were inseparable friends, and when we were out driving "Laddie" assumed to take charge of both the horse and myself; several times helping us out of what might have resulted in serious difficulties, at one time catching and holding the horse, when frightened and running away, until I could reach her. But the instance I desire to relate occurred two years ago last spring. I was driving through a rough and hilly section of the country, where the road was frequently crossed by brooks, which at that season of the year, at times, assumed large proportions, flooding both roads and bridges. I approached one of these streams, over which was a bridge about twelve feet long and somewhat raised above the road on the farther side from me. The water was up to the bridge, and beyond the bridge was a pond of water some five or six rods in width, dark and muddy and several feet deep in places. A little way from the point of crossing were some large rocks standing close together, over which the dog could cross without taking to the water, and he started to cross in that manner. When I drove onto the bridge, my horse stopped and refused to take to the water, which stood level with the bridge; my dog stood on one of the large rocks watching my progress, and when the horse stopped and refused to go on, the dog with human intelligence and reasoning instantly leaped from the rock onto the bridge, ran up in front of the horse, looked into her face, gave a sharp bark of encouragement, and then turned and deliberately walked off from the bridge into the water, all of the time looking over his shoulder at the horse, saying, "Come on," as plainly as his intelligent face could express those words. Then without any urging on my part the horse at once followed the dog into the water and across the flooded strip of road to the dry land, at times up to her belly in the flood, the dog swimming over the center of the road just in front of her.

The intelligence displayed by both animals struck me very forcibly at the time. The dog saw the difficulty, and with the quickness of human reasoning he saw the way to overcome it, and he acted on the instant. The horse had unlimited confidence in the dog, gained from their former experiences together, and she was ready to follow where he would lead without any hesitancy. Returning some hours later over the same road, the dog, always in advance, stopped a moment, just long enough to see if the horse would make the passage of the water all right, and when he saw that she raised no objection to crossing, he took to the rocks and crossed without wetting his feet.

I have often thought of this incident; the quick, active reasoning of the dog, the quick action taken by him, and the understanding of the dog's purpose and confidence in him displayed by the horse.

D. R. P. Parker.

Hermon, N. Y., October 10, 1905.

THE SECOND ANNUAL AUTOMOBILE RACE FOR THE VANDERBILT CUP.

As stated in our last issue, the second annual race for the Vanderbilt cup resulted in the triumph of two French, one American, and one Italian car. It was the first time an American machine ever was placed in an international race, and for this due credit should be given to the designer and driver of the 120-horse-power Locomobile which finished third. One of our illustrations shows this car as it crossed the line at the finish, while for descriptions of the machine and the changes recently made upon it, we refer our readers to the issues of May 27 and October 7. The day before the race this machine developed a cracked cylinder, which necessitated the replacement of one of the pairs of cylinders. Mechanics worked until 5 A. M. October 14 putting on the new cylinders and a new crank case, as this also was broken. In view of the fact that the machine had never been run with these new parts until it went to the starting line, its performance was remarkable. Its fastest time, 27:40, was made on the fifth round, and corresponds to a speed of 61.38 miles per hour. The average speed for the whole race was 56.90 miles per hour. No tire trouble was experienced, though several stops were made for gasoline, water, and oil, and to wash oil out of the clutch with gasoline.

What was undoubtedly the most consistent performance was that made by Heath, who drove the same 90-horse-power Panhard car with which he won the race last year. The only change in this machine is the substitution of a honeycomb radiator for the framed radiating coils employed a year ago. The engine is a 170 x 170 millimeter (6.692 x 6.692 inch) four-cylinder, vertical motor with steel cylinders and corrugated copper water jackets. It is fitted with a Krebs automatic carbureter and Eiseman high-tension magneto ignition. A four-speed transmission is used. This car also had no tire trouble, and its flat-tread Michelin tires appeared to be in first-class condition at the end of the race. Heath steadily rose from fourteenth position at the start to second place at the end of the fourth round, which position he held to the end. His average speed for the entire distance was 60.72 miles an hour.

The winner of the race, Hemery, drove an 80-horse-power Darracq racer of light construction and mounted on wire wheels. A companion car driven by Wagner burst a tire in front of the grand stand at the end of its second round and gave out during the fourth round from the loss of the gear box cover and the seizing of bearings in the transmission. Hemery, however, had better luck. He succeeded in covering all but the fourth round in less than 28:35. His fastest time—68.42 miles an hour—was made on the fifth round, which was covered in 24:49. At this point in the race he was sixth. The next round saw him jump to third place, which he held until the eighth round, in which he passed Heath and wrested first place from Lancia. His total time for the 283 miles was 4 hours,

36 minutes, and 8 **seconds, which means an average** speed of 61.49 miles an hour. One of our illustrations gives a good idea of Hemery and his racer as they appeared in the race, while the other picture of the engine shows what a neat appearance this has. The mechanically-operated inlet and exhaust valves are all in the heads of the cylinders, and the inlet and exhaust pipes are all on one side, the carbureter being placed in the vicinity of the muffler. The igniters are shown in the side of the cylinders, and the magneto is visible at the bottom of the picture. The Darracq cars were among the few which were run without a bonnet over the engine, and the rapid movement of the eight valve-operating levers when the car was standing with engine running at the starting line, was a feature that caught the eye. The engines have a 170 mm. bore by a 140 mm. stroke. Their performance here was in accordance with what was expected of them from what they have done abroad. These racers have no differential, which makes necessary a skillful driver to guide them properly on the turns.

The fourth car to start was, curiously enough, the one to obtain fourth place at the finish. This was the 110-horse-power four-cylinder Fiat, which, driven superbly by Lancia, took first place at the end of the first round and held it for seven rounds, gaining a whole lap on its nearest competitor. Tire trouble in the eighth round, followed by a collision with Christie just as he was again starting out, put Lancia so far behind that it was impossible for him to make up more than enough to give him fourth place at the finish. He frequently thundered by the grand stand

TABLE ARRANGED IN ORDER OF THE FINISH, SHOWING ELAPSED TIMES AND TIMES FOR EACH ROUND OF ALL THE CARS. LENGTH OF COURSE, 28.3 MILES. TOTAL DISTANCE, 283 MILES.

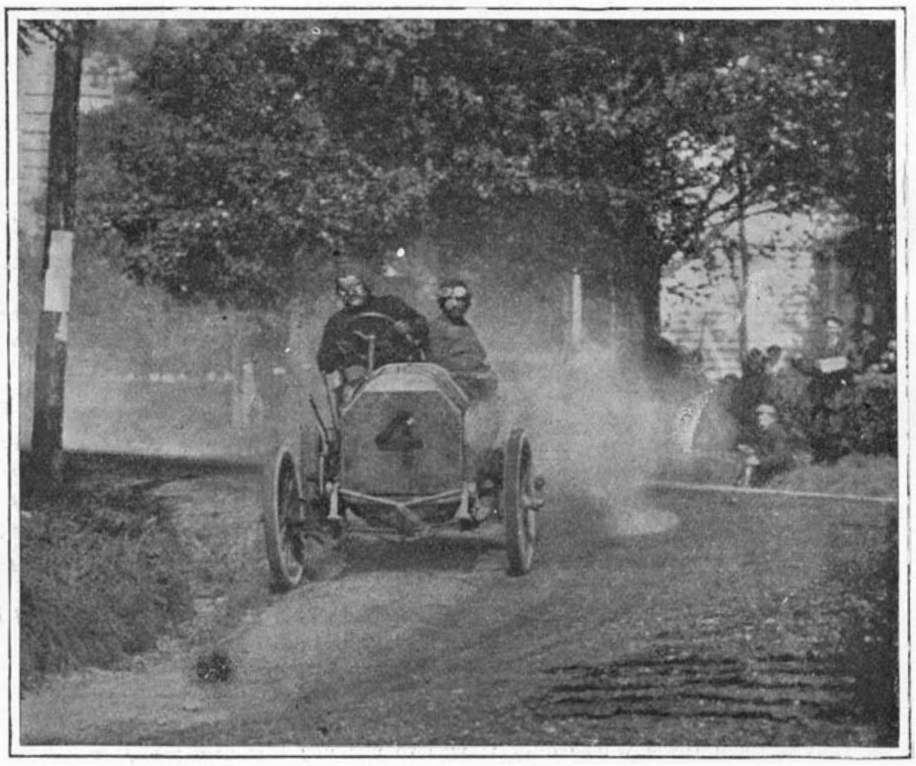
Finish.	Car.	Driver.	1st Round.	2nd Round.	3rd Round.	4th Round.	5th Round.	6th Round.	7th Round.	8th Round.	9th Round.	10th Round.
1.—No. 18.—	80 Darracq	Hemery	28.23	51:24 26:01	1:20:20 25:55	1:58:38 38:18	2:23:27 24 49	2:48:55 25:28	3:14:20 25:25	3:39:59 25:39	4:08:33 28:34	4:36:08 27:35
2.—No. 14.—	90 Panhard	Heath	28:02	55:03 27:01	1:21:56 26:53	1:48:51 26:55	2:15:21 26:30	2:41:54 26:33	3:10:59 29:05	3:44 31 33:32	4:11:41 27:10	4:39:40 27:59
3.—No. 7.—	120 Locomobile	Tracy	28:14	56:51 28:37	1:25:27 28:36	1:57:38 32 11	2:25:18 27:40	2:58:11 32:53	3:26:04 27:53	3:56:56 30:52	4:28:53 31:57	4:58:26 29:33
4.—No. 4.—	110 Fiat.	Lancia	23:49	47:20 23:31	1:10:45 23:25	1:34:03 23:18	2:02:05 28:02	2:25:50 23:45	2:49:52 24:02	4:01:09 1:11:17	4:25:00 23:51	5:00:31 35:31
5.—No. 10.—	90 Renault	Szisz	24:55	49:24 24:29	1:14:45 25:21	1:53:27 38:42	2:22 45 29 18	2:56:09 33:24	3:24:46 28:37	3:53:41 28:55	4:34:07 40:26	Runn'g at end of race.
6.—No. 8.—	110 Fiat	Nazzari	25:28	1:18:42 53:14	1:4 :17 25:35	2:08:52 24.35	2:37:56 29:04	3:04:03 26:07	3:28:40 24:37	3:53:20 24:40	Running at end	
7.—No. 20.—	90 Fiat	Sartori	27:41	55:11 27:30	1:22:20 27:09	1:49:53 27:33	2:21:06 31:13	3:02:38 41:32	3:56:27 53:49	4:34: 0 37:43	Broke crank-shaft.	
8.—No. 9.—	120 Mercedes	Warden	27:41	55:07 27:26	1:22:30 27:23	1:49:45 27.15	2:25:46 36:01	3;05:19 39:33	4:11:18 1:05:59	4:51:23 40:35	Running at end of race.	
9.—No. 2.—	130 De Dietrich	Duray	26:26	56:17 29:51	1:21:57 25:40	2:07:43 45:46	2:33:12 25:29	2:59:27 26:15	3:35:55 36:28	Running at end of race.		
10.—No. 16.—	90 Fiat	Chevrolet	28:42	56:57 28:15	1:28:32 31:35	2:07:25 38:53	2:38:41 31:16	3:09:25 30:44	Broke axle. Ran into pole.			
11.—No. 5.—	120 Mercedes	Keene	27:21	54:24 27:03	1:23:05 28:41	1:54:10 31:05	2:20:33 26:23	Ran into telegraph pole and broke front wheel.				
12.—No. 3.—	60 Pope-Toledo	Dingley	29:44	1:00:55 31:11	3:42:33 2:41:38	4:21:35 39:02	4:57:20 35:45	Running at end of race.				
13.—No. 19.—	40 White	White	51:31	1:36:23 44:52	2:18:54 42:31	3:09:14 50:20	Abandoned race at Lakeville. Tire trouble.					
14.—No. 15.—	90 Pope-Toledo	Lytle	29:15	2:00:17 1:31:02	2;35 49 35:32	3:15 52 40:03	Ran over dog, bent steering gear, and broke chain.					
15.—No. 6.—	80 Darracq	Wagner	24:56	49:49 24:53	1:30:38 40:49	Tire burst at end of first round. Bearing seized.						
16.—No. 1.—	120 Mercedes	Jenatzy	24:52	49:25 24:33	1:22:06 32:41	Cracked a cylinder.						
17.—No. 11.—	60 Christie	Christie	58:08 30:08	1:28:20 30:12	2:44:30 1:16:10	Wheels broken in collision with Lancia.						
18.—No. 12.—	120 Fiat	Cedrino	25:36	53:54 28:18	Broke oil pipe to engine.							
19.—No. X.—	120 Mercedes	Campbell	28:21	Lost gasoline tank.								

round when the race was called off. It had a great deal of tire trouble, and passed the grand stand with one of its rear wheels running on the rim after Hemery and Heath had finished. Despite the fact that one pair of cylinders had cracked and were replaced shortly before the race, this car made the best performance of any of the German team. Its fastest round, the fourth, was made in 27:15—a speed of 62.31 miles per hour; while Keene's fastest, the fifth, was done in 26:23 (64.36 miles an hour). Jenatzy covered his second round in 24:33, which equals a speed of 64.36 miles per hour.

Next to Hemery and Heath, the other member of the French team who made the best showing was Szisz on a 90-horse-power Renault racer. This car made its fastest time on the second round, which was run in 24:29 (69.26 miles an hour) and at the conclusion of which Szisz passed Keene directly in front of the grand stand, and thus crept up from third to second place. This position he subsequently lost, but he held fifth place at the end of his ninth round, and would in all probability have finished fifth had he been allowed to do so. His engine missed fire and overheated during the last few rounds, and the horseshoe-shaped dashboard radiator was steaming badly. Nevertheless, Szisz kept his car in the race, although obliged to stop occasionally for water. As can be seen from our illustration of it at the starting line, the Renault was one of the most picturesque of the racers, with its rounding, bug-shaped body, hung very low, and painted red. It made a much better showing than in last year's race, in which it broke its universally-jointed drive shaft in the second round.

The De Dietrich racer—No. 2, driven by Duray—had the second largest engine of any in the race. It is rated at 130 horse-power, and its four cylinders are 190 millimeters (7.480 inches) bore by 150 millimeters (5.905 inches) stroke. This machine, however, did not show very great speed. Its fastest lap was made in 25:29—at the rate of 66.63 miles per hour. It was still running at the end of the race, being then on its eighth lap.

The Start of the 90 H. P. French Renault Racer. This Car Was Running Fifth at the Finish.



Lancia on His 110 H. P. Italian Fiat Making One of the Turns at a High Speed.

TWO OF THE LEADING CARS IN THE VANDERBILT CUP RACE.

at 80 to 85 miles an hour. His fastest lap, the fourth, was made in 23 minutes and 18 seconds at a speed of 72.88 miles an hour. This was the fastest time made by anyone in the race. During his first seven rounds Lancia's range of speed variation did not exceed 44 seconds, which is remarkable, indeed, for a course of the length and with the number of turns that the present one has. Lancia displayed great skill in taking the turns, which he did at a high rate of speed. Had it not been for his collision with Christie, which was due to his own foolhardiness, he would have undoubtedly won the race. His total elapsed time was 5 hours and 31 seconds, which is equivalent to an average speed of 56.50 miles an hour.

Of the four remaining Italian cars in the race, that driven by Nazzari was the only one which would have been able to finish. This was on its ninth round when the race was called off. Its fastest lap was done in 24:35, which was 1 minute and 17 seconds slower than Lancia's, and meant a speed of 69.07 miles per hour. The three remaining Fiat cars—No. 12, driven by Cedrino, 16 driven by Chevrolet, and 20 driven by Sartori—dropped out because of a broken oil pipe, a collision with a telegraph pole, and a broken crank-shaft. The first quit during its third round, and the other two during their seventh and ninth.

Of the four German Mercedes machines in the race, No. 1, driven by Jenatzy, cracked a cylinder and dropped out when half way around on its fourth lap; No. 5, driven by Foxhall Keene, collided with a telegraph pole at the dangerous S turn; X, driven by Campbell, lost its gasoline tank in the second round; and No. 9, driven by Warden, was the only one which was likely to have finished. This car was on its ninth

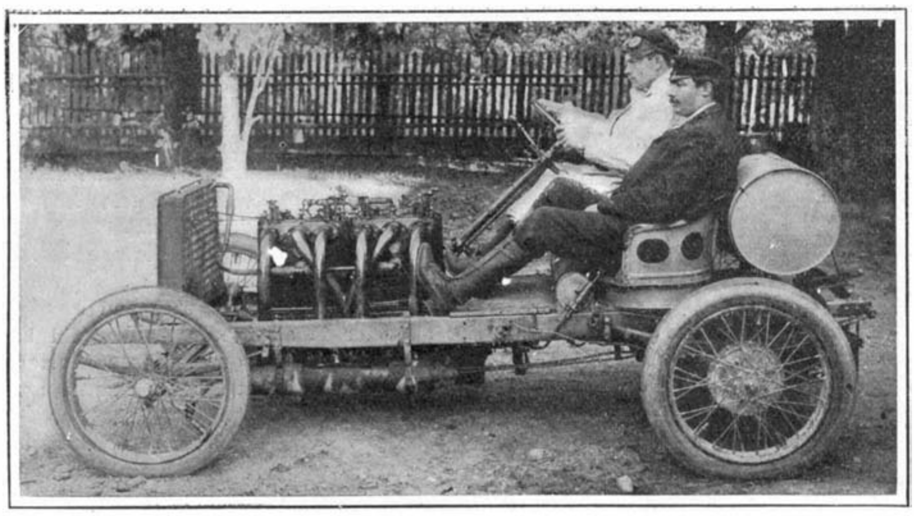
Considering the performance of the Italian and German teams, that made by the American team was not so bad as, at first sight, it might appear. With Tracy on his Locomobile third, and Dingley still running and on his sixth round, although with a cracked cylinder, the American team was but little behind the Italian, and had made a better showing than the German. One cylinder of the 60-horse-power Pope-Toledo cracked when the car had nearly completed its third round. After over two hours spent in trying to repair it, Dingley finally cut out the cylinder and ran on three for the balance of the race. The six-cylinder Pope-Toledo, driven by Lytle, ran over a large dog in the second round. As a result, one of the chains broke a short time afterward and the steering gear was damaged, the machine finally running into a fence at Lakeville during the eighth round.

The Christie direct-drive racer was the only car which did not start on time. No explanation was given, and when it appeared 28 minutes late and made a flying start, everyone wondered what had been the cause of delay. The machine made two rounds in 30:08 and 30:12 respectively, but it seemed to be missing fire and not working properly. The third round consumed 1¼ hours, and on the fourth, after discovering that his gasoline valve had not been turned on sufficiently, Mr. Christie was just beginning to get back to his accustomed speed when he came upon Lancia as he was pulling out from a tire station, and, turning into the ditch to avoid him, banged his rear wheel hub against Lancia's rear wheel tire. His car scraped by Lancia's and swung around in the road in front of

the latter, pointing toward him. The outer rear wheel collapsed as the car swung round, but the machine did not upset. Lancia went by without colliding a second time, but was obliged to stop and make repairs. This unfortunate accident lost Lancia the race, and deprived Christie of any further chance of showing what his car could do. The night before the race he was speeding the engine with the wheels jacked up, when a connecting rod broke at the wrist pin, punched a hole through the crank case, and cracked the cylinder thirds of the way around on his fifth lap. The machine was then running as shown in our photograph, with one of the front tires missing. This tire came off at the Guinea Woods turn, and the car narrowly escaped hitting a telegraph pole as a consequence.

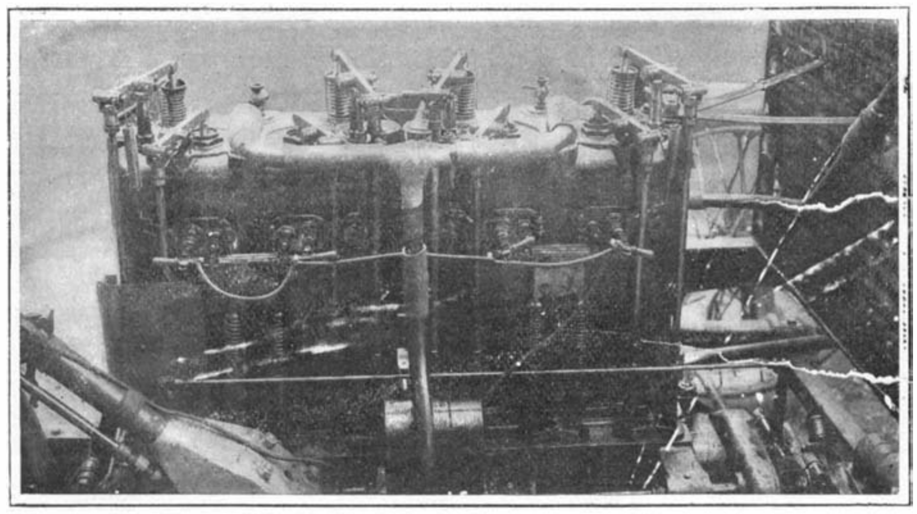
A comparison of the racers from the standpoint of cylinder capacity is interesting, as it shows in a measure how much one motor may exceed another in efficiency. The largest engine in the race was that on the Locomobile. The total volume swept by the pis- buretion obtained with the Fiat carbureter is attested to by the blue flame and extremely heavy explosions emitted from the exhaust pipes. The Mercedes engines ranked fifth with 984.44 cubic inches cylinder capacity, and the Panhard sixth with 966.52. The winning Darracq car had only 775.84 cubic inches. The valves of this engine also are located in the cylinder head, as can be seen in the illustration below.

An order for 1,500 steel passenger cars is to be



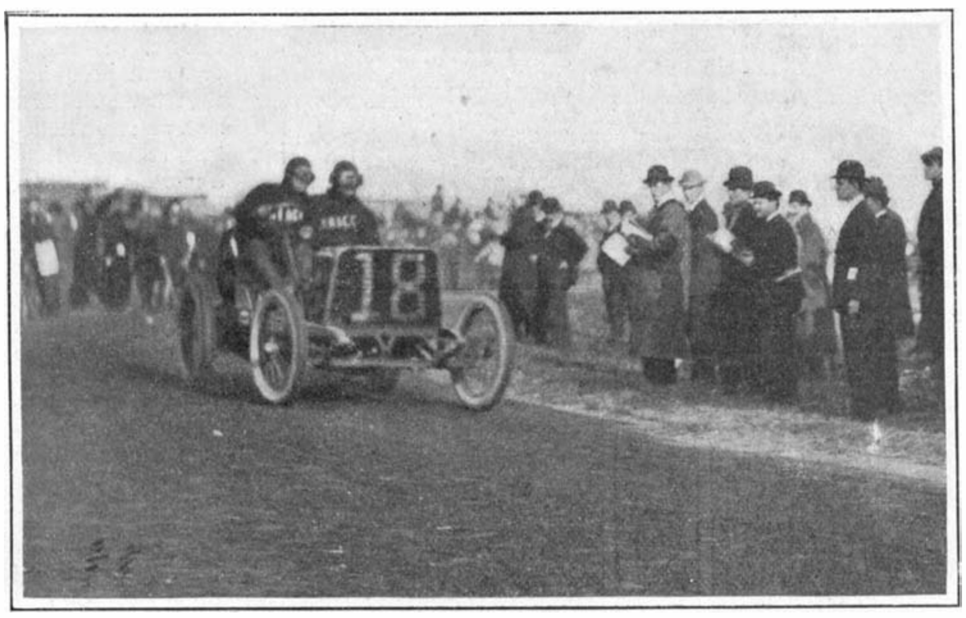
Hemery, the Winner, on his Darracq Racer. Average Speed, 61.49 Miles an Hour.

The view shows the exhaust and inlet pipes of the engine, and muffler below. Note the wire wheels, short wheel base, and light appearance of the car.

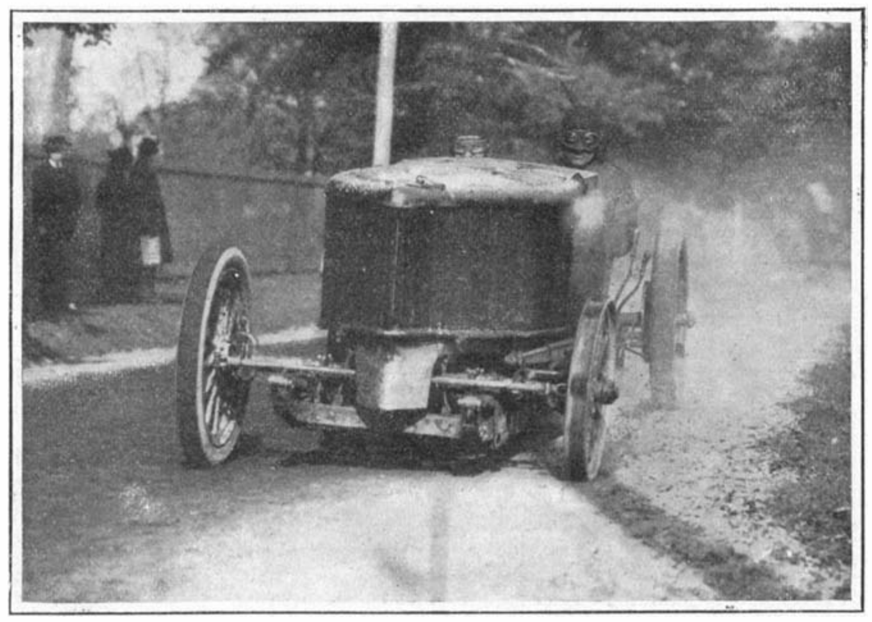


The 80-H. P. 4-Cylinder, 6.692x5.511-Inch Engine of Hemery's Car.

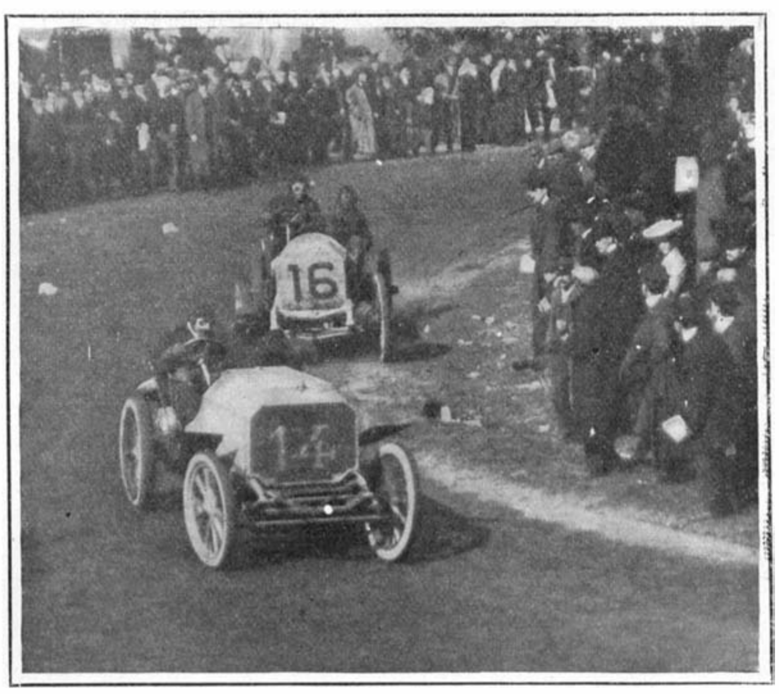
Note the valves in cylinder heads, and make-and-break igniters in cylinder walls. The engine was one of the smallest in the race.



The Winning Darracq Making the Turn at New Hyde Park.

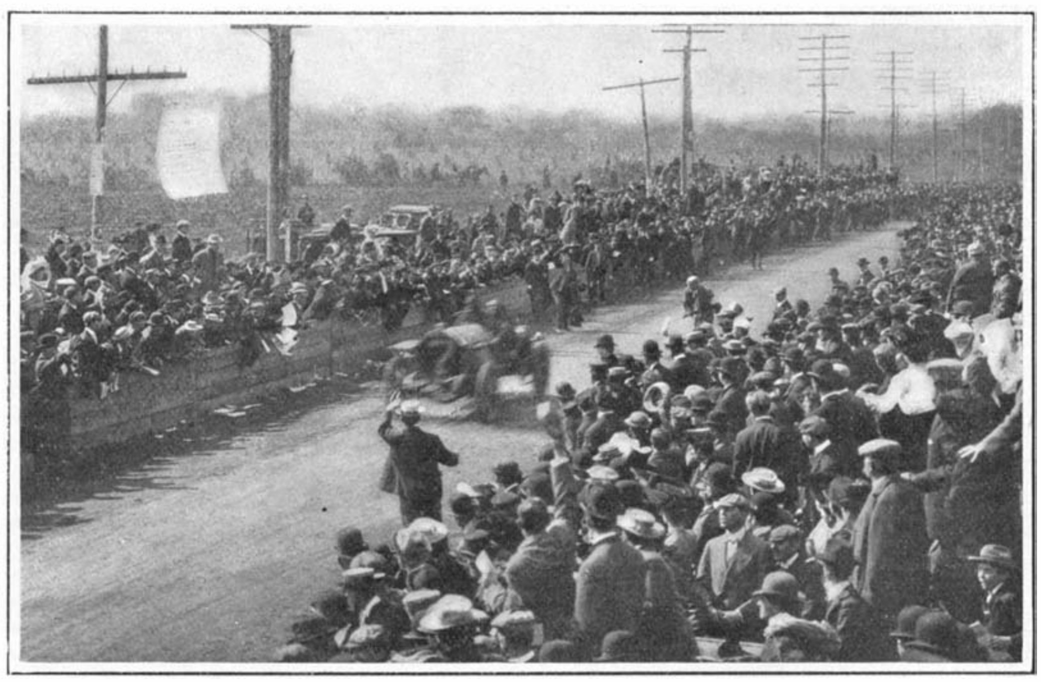


White Steam Racer Running Without a Tire.



Heath (Panhard) Closely Pressed by Chevrolet (Fiat) at a Turn.

No. 14 finished second at an average speed of 60.72 miles an hour.



The Locomobile Finishing Third. Average Speed, 56.90 Miles an Hour.

This is the first American car to win a place in an international race.

SOME INCIDENTS AND CARS IN THE SECOND VANDERBILT CUP RACE.

at its base. Nothing daunted, he set to work to make repairs, and, after working all night, he managed to get the machine running again so as to start when he did.

The White steam racer, No. 19, started very slowly and quietly, but it had not gone 5 miles before it had a flat tire. Tire trouble pursued it in almost every round, and it had to stop frequently also for water, oil, and fuel. Of the four rounds this car made, the third in 42:31 (39.93 miles an hour) was the fastest. Walter White finally gave up the struggle when two- tons of this engine is 1,194.56 cubic inches. Next in order comes the De Dietrich engine, with 1038.37 cubic inches, while that of the six-cylinder Pope-Toledo is third with 1,017.86 cubic inches. The engine of the Fiat car, which developed the highest speed of any in the race, ranks fourth, as its 180-millimeter bore by 160-millimeter stroke gives it only 994.08 cubic inches. The superior speed obtained with this comparatively small engine shows that the arrangement of valves in the cylinder head (which was described in Supplement No. 1545) must be very efficient, while the perfect car- placed by the Pennsylvania Railroad Company. It is intended to use the steel cars on the Pennsylvania fast trains. Their use will reduce to the minimum the possibilities of fatalities in wrecks as well as eliminate the liability of telescoping. The cost of the proposed order is estimated at $1,500,000. The new cars will have steel floors, sides, and roofs. There will be nothing about them that can be easily broken or catch fire in the event of a wreck. They will weigh little more than the present wooden coaches. Steel cars are now being tested on the Long Island Railroad.

ARCHÆOLOGICAL DISCOVERIES AT ANTINOË.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

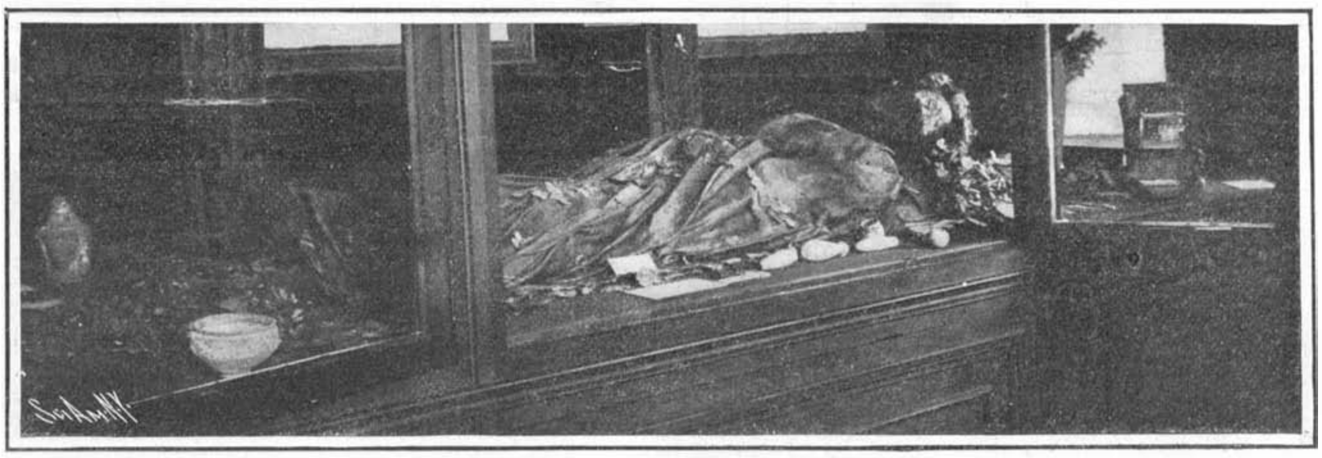
Recent archæological work was interestingly shown in the exhibition lately held in Paris by the Society of Archæological Research, a comparatively new association which nevertheless counts many well-known savants among its members. The exhibit of the eminent Egyptologist, M. Gayet, of some of his latest discoveries at Antinoë, forms one of the most interesting features. This highly important collection will be placed in the Louvre, where special quarters are to be prepared for it.

M. Gayet has been engaged within recent years in making excavations at the ruins of Antinoë, the city founded by the Emperor Hadrian to commemorate the death of his favorite, Antinous. The specimens which are here illustrated are among the latest discoveries of M. Gayet during the past year.

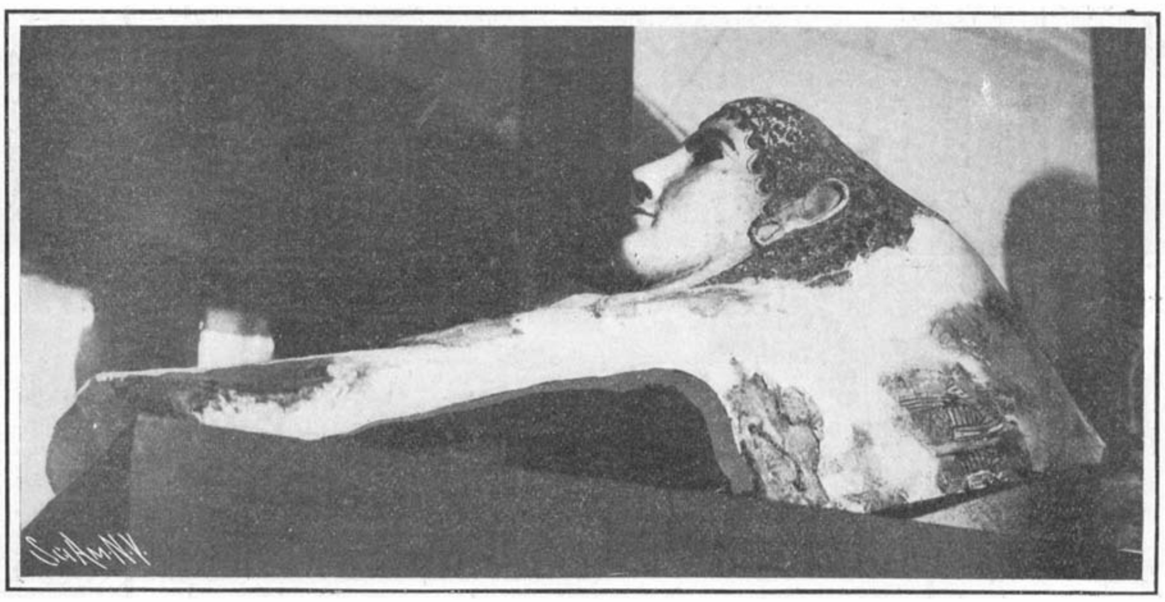
These discoveries were principally of different forms of tombs and the embalmed bodies and objects which they contained. In these tombs the bodies are clothed, generally, in the garments which the person was accustomed to wear. In other cases the bodies are wrapped in several winding sheets which are held in place by cloth bands. Over this is placed a mask of painted stucco or a portrait of the deceased. Often a single garment with a design of flowers covers the body. Embroidered cushions filled with feathers support the head. Around the body, generally at the head and feet, are placed objects which the person used in life. Different methods were employed for preserving the mummies. We find the black mummy, prepared with bitumen but not embalmed, wrapped in sheets and wound around with bands. The head and breast are often covered by a mask or plate of decorated plaster. Then we find the bodies which are embalmed and clothed in their accustomed garments. We illustrate some of the masks which are used to cover the first-mentioned type of mummies. As required by the Egyptian ritual they are life-like representations of the features. Some of the masks are painted in colors, while others are covered with gold-leaf and have eyes of enamel. Some of the bodies are those of persons who took part in the Olympic games which were instituted in honor of Antinous. We find a charioteer and a gladiator who were champions of the hippodrome of Antinoë. The most interesting of the bodies is that of a young woman, Khelmis, who seems to have been a singer devoted to the celebrations of the deity, and who was interred with the different objects belonging to the worship. In another tomb was found the body of Glithias, whose office it was to clothe, ornament, and perfume the divine statue and to burn incense before it. It was accompanied by perfume flasks, wreaths, and garlands.

Among the most interesting tombs is that of the singer Khelmis. The sepulcher was built of masonry and contained the remains of a plaster-covered wooden case which inclosed the body. At the head and feet were fragments of wood slabs which were covered with paintings of the Egyptian ritual. In these an image of Isis appears, accompanied by inscriptions, the greater part of which had been badly copied and were illegible. This is often the case in similar relics of this epoch of the Greek sepulchers, when the person was interred according to the Pharaonic rites merely because of his employment. Only the signs which represented the name and titles of the person had been reproduced distinctly, and this so that there should be no mistake as to his identity in the other world. The name is thus found to be "Khelmis, the precious singer of the Osiris Antinous." The body of the young woman is admirably preserved, and no doubt all the resources of the embalmer's art were brought into requisition. The body is clothed in the long veil of Isis, which closely resembles the drapery we find on the Tanagra statuettes. The veil, draped over the lower half of the face, is quite characteristic, though this was the first time that it had been found at Antinoë. The stuff is a kind of silk tissue, dyed a pale yellow, while the robe is of the same color. A diadem of leaves surrounds the forehead, while a garland starts from the neck and descends to the feet, after being wrapped several times about the body.

In the case had been placed different objects relating to the employment of the deceased. At the head was a statuette of Isis-Venus, of painted plaster, and hollow in the interior. The hair is tinted a light red and is surmounted by a diadem with the attributes of the goddess. At the feet was a pair of crotales in bronze, of rather large diameter, and joined by a leather thong. The pottery which accompanied the mummy consists of red and black figured Greek vases, and there is also a number of small alabaster perfume flasks which may be distinguished at the side of the body. Very curious is the miniature bark containing a marionette theater. It has a set of movable figures which are mounted upon pivots and which were made to move by means of strings. The latter were still visible at the time when the tomb was opened. The sacred bark contains a small platform in the center, mounted in front of which is an upright panel. The panel has a square opening which can be closed by two shutters. In the foreground are the movable figures, crudely carved out of wood, and these can be seen from the front. They seem to represent Isis, accompanied by Osiris, with the sacred tree and the emblem of Horus. The bark containing the miniature theater seems to have been used in celebrations of the deity.



The Body of Khelmis.



The Mask of Painted Plaster Which Was Placed on the Mummy.

Mummy Masks. A Painted Plaster Head and a Gilded Head With Enameled Eyes.

ARCHÆOLOGICAL DISCOVERIES AT ANTINOË.

STRIPED STEEDS.

BY J. CARTER BEARD.

The recent importation of a specimen of the rare Grévy zebra obtained by W. P. Ellis of King Menelik of Abyssinia, who, Mr. Ellis says, possesses five others, has naturally attracted attention to the fact that there are many varieties of zebras. That there are not only different varieties but at least four distinct species of these horse-like animals more or less marked by dark stripes across their bodies, seems to be scarcely known to those who have not had occasion to study the subject, and yet the differences in the four species can be perceived at a glance when the animals are brought together as they are in the accompanying illustrations.

The zebra best and longest known outside of Africa, the one that has given its name to all members of the genus *Equus* distinguished by bodies marked with stripes, is the mountain zebra (*Equus zebra*), the *wilde paard* or wild horse of the old Dutch African colonists. It has now become so rare that it is even supposed to have become extinct in the district.

Of all the zebras this species possesses the most complete and perfect suit of markings. In writing of it Mr. C. L. Sutherland, fellow of the zoological society in England, says: "Although the true zebra is much more beautiful than the allied species known as Burchell's zebra, there can be no doubt that it is more asinine in its build, not only in the form of its head and tail but markedly in the length of its ears. Nevertheless the animal is full of grace and beauty. It is true its shoulder is straighter than would be approved in a horse, that the quarters are shorter, the neck thicker, and the cannon bones longer, but no one can look at the animal without being struck by its extreme beauty."

From its smaller size, straighter shoulders and more asinine form the mountain zebra is less adapted for the service of man as a beast of burden or draft animal than the Burchell's zebra; nevertheless, although it is a more difficult animal to handle and break in than the comparatively larger and stronger animal referred to, it can be and often is tamed and ridden. The Grévy zebra brought to this country by W. P. Ellis is the first of the species that ever entered the western hemisphere. A specimen sent alive to the Jardin des Plantes, Paris, some years ago was the first, probably, that ever left Africa.

Sir William Flower, writing of this species, says: "Being obviously different from any that had hitherto been seen in Europe it was named by M. Milne Edwards *Equus grevyi* in compliment to his political chief. On a white ground color it is very finely marked all over with numerous delicate, intensely black stripes, arranged in a pattern quite different from those of the other species. In view of the great variability of the markings of these animals, as long as but one specimen of this form was known some doubts were expressed as to whether it might not be an exceptionally-colored individual of one of the other species; but subsequently additional specimens, presenting almost exactly the same characters, have been received from Somaliland, and it seems something more than probable that all the zebras known to exist in the northern districts of East Africa belong to this species."

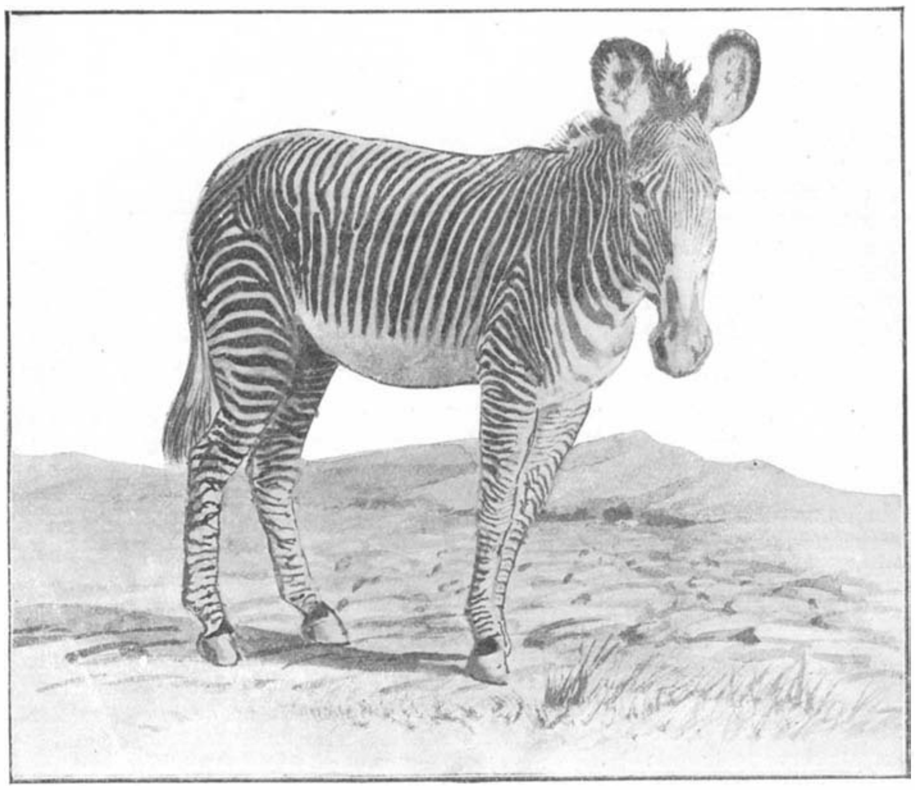
A. H. Newmann, in a letter from Laiju, East Central Africa, writes: "As we emerged from the bush we saw zebras ahead of us. . . . I was soon made aware by their great, wide ears and their different markings that they were not the common Burchell's species.

I gave one of them a shot, and following him up found him lying down as if alive, but really dead. A beautiful creature he was—a fine young stallion, large and far handsomer than Burchell's zebra, the stripes much narrower, except one very broad, dark one down the back with wide white spacing on either side. The cry of this zebra is quite different from the bark of the common kind, being a very hoarse grunt, varied by sounds approaching a whistle. The Mackenzie River seems to be about their limit here, as on the west side of its most easterly branch I saw only the *E. burchelli*."

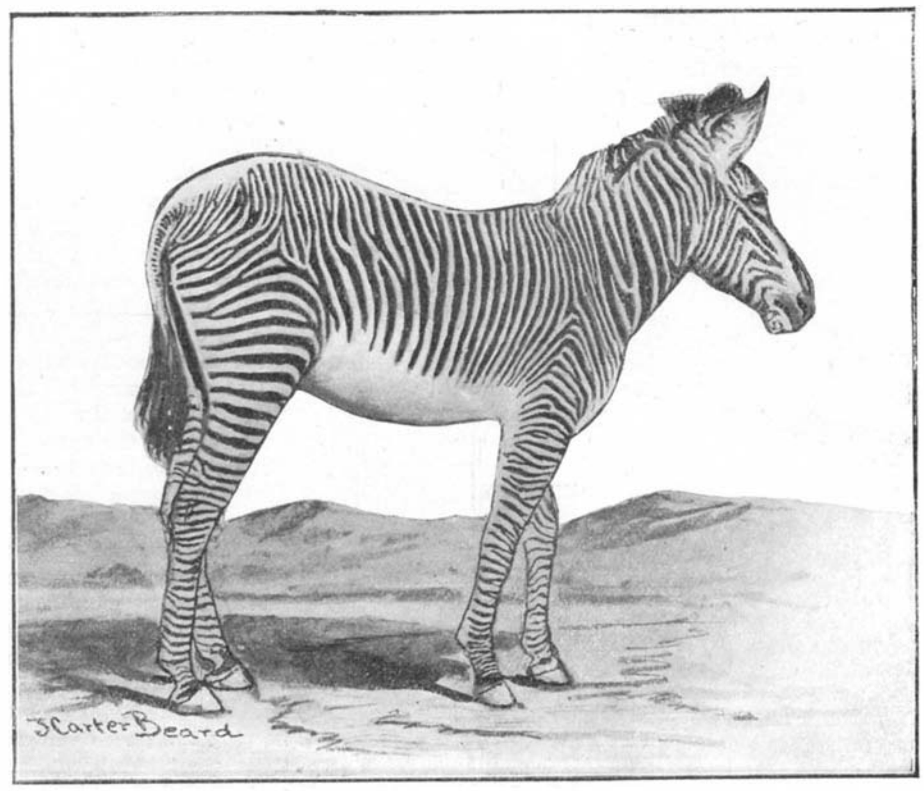
The Grévy zebra is a taller and more slender animal than is the mountain species. Burchell's zebra approaches the horse in type as the common zebra approaches the ass. The mane is more abundant, the tail more horselike, the ears shorter, the proportions more equine and the size greater. It is quite easily broken to harness and readily becomes domesticated. The Cape colonists some time ago became aware of the fact that this animal is a desirable beast of draft and burden and are making considerable use of it for such purposes. From late advices, indeed, we learn that they are fast taking the place of mules. The zebra, it appears, is immune from the terrible African scourge called "horse sickness," which entails upon owners of horses and mules enormous losses during the summer season. The zebras when harnessed stand quite still and wait for the word to go; they pull up when required, are perfectly amenable to the bridle, and have softer mouths than have mules. They never kick. The only apparent vice they possess is that when first handled they have an inclination to bite, but as soon as they get to understand that there is no intention of hunting them they give this up. They are in harness as good and reliable as the best mules. The last species of the striped Equidæ left to notice is the quagga (*Equus quagga*). This animal, like Burchell's zebra, was more equine than asinine in build and character. It is now almost, if not entirely, extinct, like so many valuable species of animals, through the reckless improvidence and love of killing for the sake of killing on the part of the human race.

As will be seen by the illustration, which is the copy of a study from life taken from the last living specimen of the race known to exist, only the head, the neck, and the forequarters of the animal were striped. The ground color was a light reddish brown and the stripes white in color.

There is in the parish church of Rotherham one of the oldest and most celebrated specimens of organ building in Great Britain. The instrument was originally built in 1777 by John Snetzler, and still retains much of its original portions. In 1850 the first addition was made, and recently several new features were introduced, at a cost of $5,000.

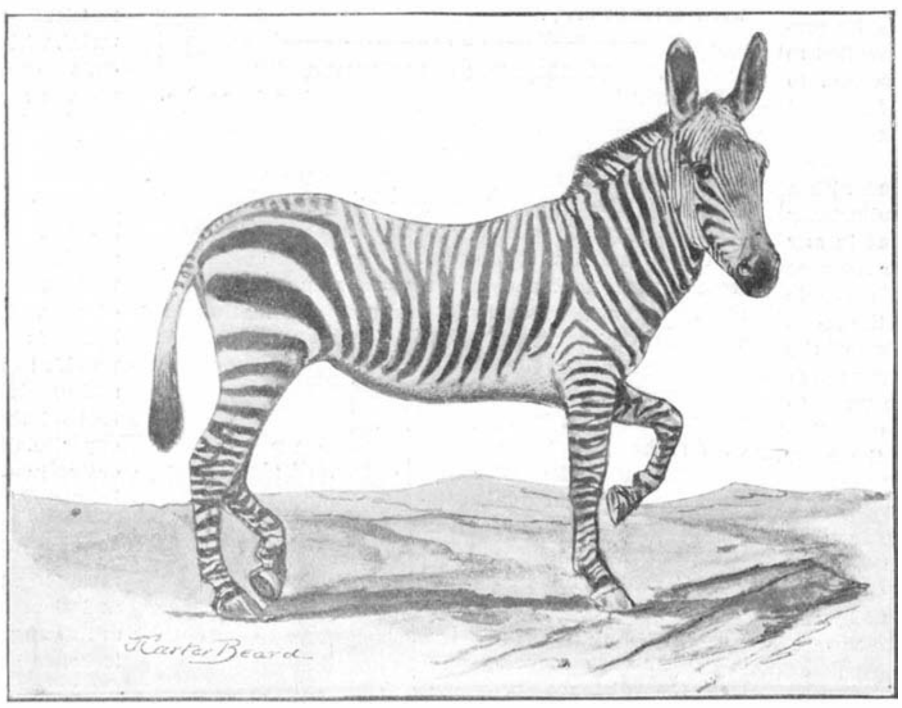


Front view adapted from a photograph, showing large and peculiarly shaped ears. This species is more nearly allied to the ass than the horse.



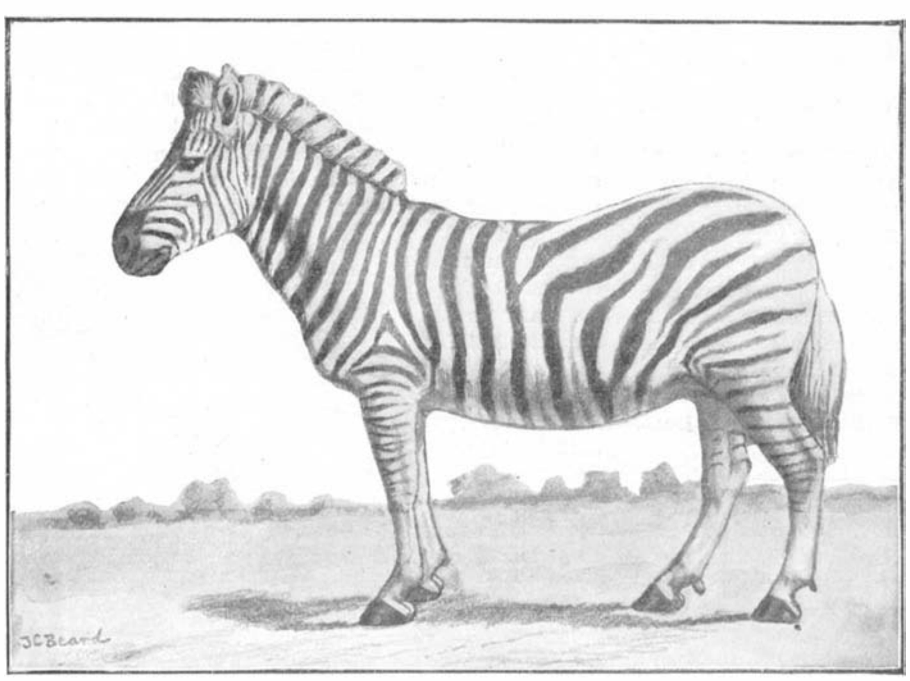
Rear view showing broad white stripe down the back and absence of stripes on lower part of body. Adapted from a photograph from life.

Lately Discovered Grévy's Zebra.



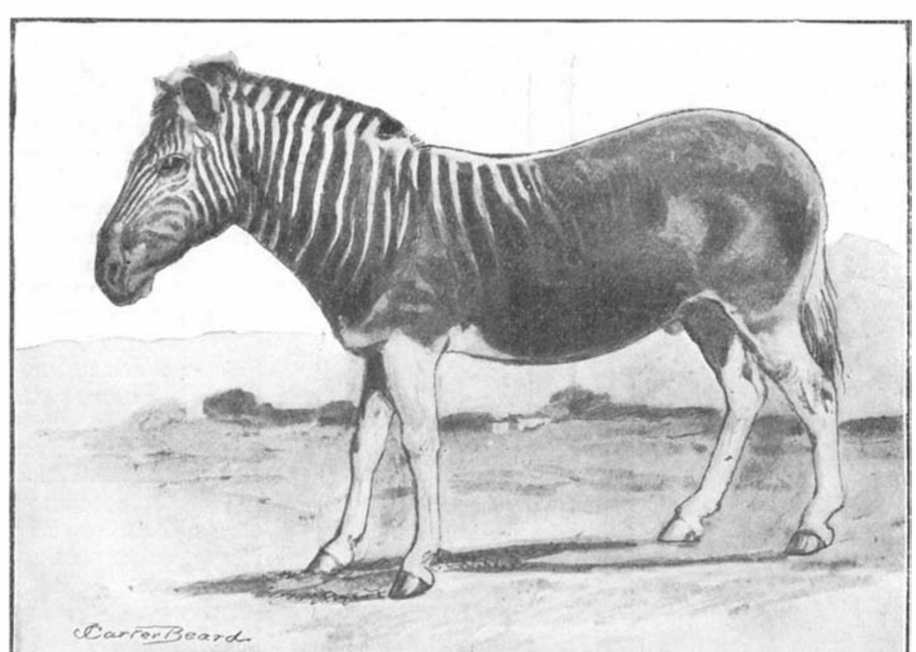
The most typical representative of the striped group. This animal, like Grévy's zebra, approaches the ass rather than the horse.

Mountain Zebra.



This horse-like zebra is the one most often broken to saddle or harness.

Burchell's Zebra.



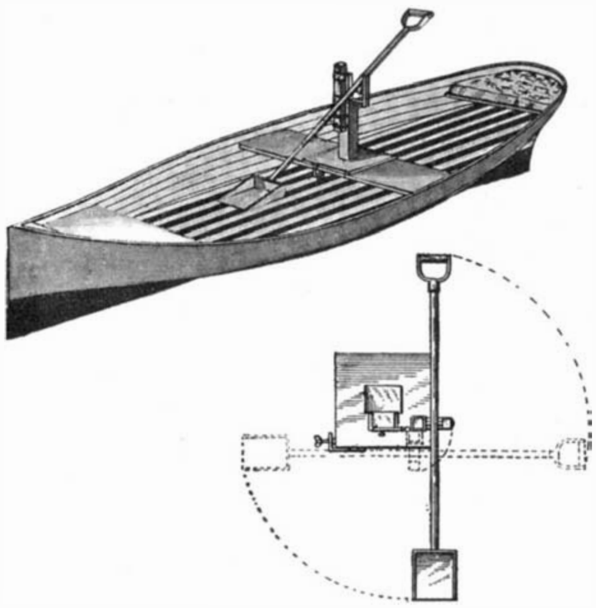
A study from life of a specimen formerly in the Zoological Society gardens, London. The species is now supposedly extinct. This is one of the equine or horse-like zebras.

The Quagga.

STRIPED STEEDS.

BOAT BAILER.

A patent has just been granted to Mr. Herbert P. Van Wagenen, of Rye, N. Y., on an improved device for bailing out the water from rowboats and the like.



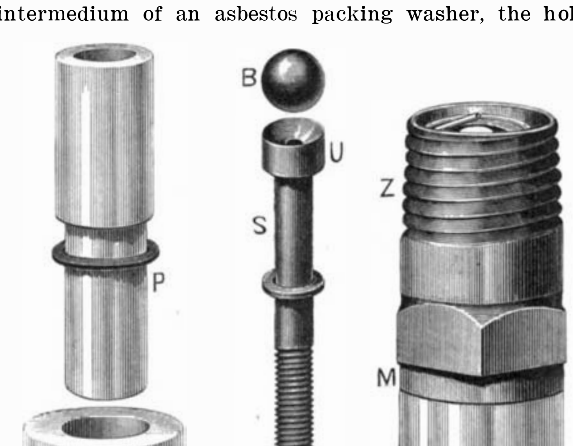
BOAT BAILER.

Such boats are seldom provided with protection from the weather, and after a storm the owner is obliged to undertake the tedious task of baling out the rain water that has collected in the boat, or the water that has been washed in by the storm. The object of Mr. Van Wagenen's invention is to facilitate this task by providing a simple device which may be readily applied to the thwart and which will not require the operator to stoop or bend over while using it. The improved bailer is mounted on a plate which may be secured to the thwart by means of hinged clamps. A standard extends upward from the plate and is provided with a pair of guide straps within which a post is adjustably supported by pins, which may be set as desired in any of the series of holes in the post. Hinged to the post is a yoke piece in which the handle of a scoop is mounted to swing. The hinged yoke permits the scoop to be swung laterally, as shown in the plan view of the accompanying engraving, while the pivotal connection between the handle and the yoke permits the scoop to be swung in a vertical plane, as well. In operation the scoop is first dipped into the water in the boat, then raised and turned laterally to discharge the water over the side of the boat. Owing to the adjustable connection of the post with the standard, the fulcrum of the scoop may be raised or lowered to suit the convenience of the operator. After the bailing operation is completed the device may be easily removed by unscrewing the clamp which holds the plate to the thwart.

A NEW SELF-CLEANING SPARK PLUG.

The annexed cut shows the general appearance and details of a new spark plug which has just been placed on the market, and which, according to its inventors, Messrs. M. C. Hopkins and James Marini, offers several important improvements.

The new plug consists of the usual metal shell, *Z*, having a seat inside upon which rests, through the intermedium of an asbestos packing washer, the hol-



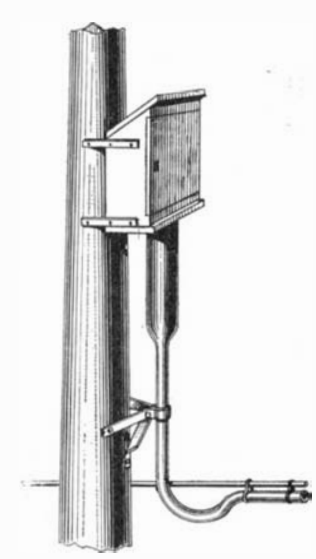
A NEW SELF-CLEANING SPARK PLUG.

low porcelain stem, *P*. The metal rod which passes through *P*, and which seats upon a shoulder in it near one end, is also hollow and has a rounded cavity, *U*, at its inner end, intended to receive a small steel ball, *B*, which stops up the hole in *S*, and keeps the gas from escaping when the motor compresses. Upon the suction stroke the ball is drawn away from the hole in *S*, and fresh air is drawn in past the porcelain at a high rate of speed, thus exerting a cleaning action upon the latter. A stiff wire, which is coiled around and sprung into a groove within the shell, has one end projecting out over the ball and acting as a stop for the latter upon the suction stroke of the motor, while on the compression stroke the ball being driven to its seat forms a gap for the spark to jump between the ball and the wire. The plug is completed by a heavy porcelain cap, *H*, which fits over *P* and is clamped against metal and asbestos packing washers, *M* and *R*, by means of the cap, *W*, and a small nut, both of which are threaded on *S*. A suitable thumb nut holds in place the secondary wire.

One would suppose that the constant hammering of the ball against the wire would spring the latter some and lengthen the spark gap, but this is not the case. Furthermore, the additional air drawn in through the spark plug has a beneficial action on the mixture, and the motor is found to develop somewhat more power with, at the same time, a tendency toward decreased gasoline consumption. Another curious feature is that in starting a motor equipped with the new plug the gasoline mixture does not need to be enriched, as is ordinarily done, by flooding the carbureter. In fact, a very weak mixture will ignite more readily than a rich one which, with most plugs, is requisite. Besides keeping the plug clean under the most adverse conditions, the intermittent influxes of air serve to keep it cool, so that there is no trouble from porcelains cracking owing to the expansion resulting from great heat. The plug would seem to be an ideal one for air-cooled motors on this account. The automobile editor of this journal has given it a thorough test and found it to work satisfactorily.

HANGER FOR CABLE HEADS.

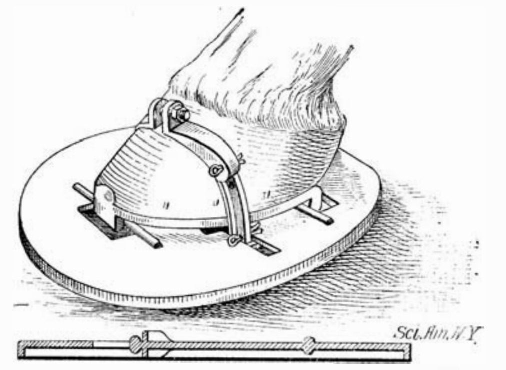
Pictured in the accompanying engraving is an improved hanger adapted particularly for use in connection with the heads or portions of aerial conducting cables which are made into distributing boxes, and the like. The hanger is a very simple one and yet makes a perfectly secure support for the cable head. In the illustration, the cable is shown as suspended from a wire or strand in the usual manner. Thence the cable extends vertically upward, terminating in a head, or enlargement, which enters the distributing box. The improved hanger is located on the pole below the box. It is formed of three wrought-iron bars which are fastened together with a single bolt. The two horizontal bars are formed with curved ends adapted to embrace the cable, the distance between them being such that they may be drawn into contact with the cable by tightening the bolt. The third bar, which at the upper end extends between the horizontal bars, serves as a stay for them. The lower end of the stay is bent at right angles so that it may be secured to the post by a lag screw, thus bracing the hanger by taking the downward thrust of the weight upon it. In use the horizontal bars are first secured to opposite sides of the pole, at a suitable distance below the cable head, and the vertical portion is introduced between the curved ends. The stay is then fastened to the pole and the bolt is tightened so as to clamp the curved ends of the bar onto the cable, and thus support it. A patent on this improved hanger has been secured by Messrs. Frank M. Winn and Louis F. Doellinger, Marshalltown, Iowa.



HANGER FOR CABLE HEADS.

ODDITIES IN INVENTIONS.

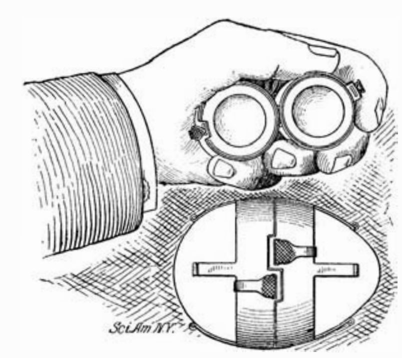
Soft-Ground Horseshoe.—Quite a demand has recently arisen for soft-ground horseshoes, that is, broad, flat shoes which, owing to their large area, will prevent the feet of horses from sinking unduly into the ground. A simple shoe of this type has recently been invented, which is so designed that it can be easily reversed. The advantage of this design will be particularly felt in winter-time, as the shoe is prevented from balling up with snow. As the reversible shoe is smooth at one side, it will be found advantageous for use on horses when mowing lawns. It consists of a plate with a flange projecting from one face along the periphery and formed with slots to admit the calks of a horseshoe. Ribs on the plate prevent the calks from sliding back and forth on the plate. At each side a T-slot is formed to admit the head of a clamping strap. The two straps are bolted together over



SOFT-GROUND HORSESHOE.

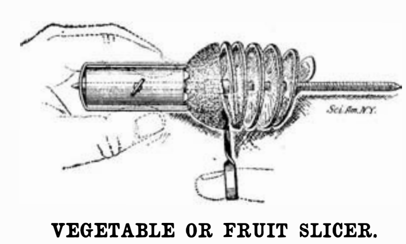
the hoof of the horse, as shown. One of the straps is formed of two members which are adjustably connected by means of a pin. This permits of adapting the shoe to different sizes of hoofs.

Egg Opener.—In hotels and restaurants, it is generally the custom, when serving boiled eggs, for waiters to open the eggs in the presence of customers, a practice which is very inconvenient and annoying as it frequently results in spilling part of the egg, and soiling the table linen, and producing an unpleasant effect upon the customer. To avoid such circumstances, Messrs. A. C. V. Merrifield and H. Potter, of New York city, have invented a device which facilitates breaking open the shell, and then serves as a holder for the two parts of the shell, permitting the contents to be removed with ease. The device consists of two bands which are hinged together at one side. Each band is made of spring metal or other resilient material, with the ends overlapping, so that it may be expanded or contracted by a pressure of the hand, thus adapting it to various sizes of eggs. Each band is also provided with spring fingers to hold the egg, and with a spring arm on the side opposite the hinge. These spring arms terminate in cutter blades, which pass through slots in the bands. In use the two bands are swung apart to admit the egg, and then they are closed upon it. The device is now held with a band in each hand. The spring arms are pressed inward, making two incisions in the shell and then before releasing the spring arms the bands are swung apart, breaking open the shell. As the egg is being broken open it should be inverted to permit the yolk to drop into the glass, and then the two parts may be held in the hand as illustrated, leaving the other hand free to remove the white of the egg.



EGG OPENER.

Vegetable or Fruit Slicer.—The accompanying engraving illustrates a rather ingenious device for slicing vegetables or fruit. It comprises a threaded rod or pin on which the vegetable or fruit is impaled, and a knife adapted to be revolved spirally around the rod. The handle which carries the rod is formed with prongs which pierce the end of the fruit and prevent it from turning on the rod, while it is being sliced. In addition to the prongs the handle carries a pair of spring arms formed with jaws at their outer ends which assist in holding the fruit during the slicing operation. A nut is threaded onto the rod and carries the knife. In use the device is held as illustrated by dotted lines, and by pressing the finger against the finger piece at the outer end of the knife, the latter is revolved about the rod; but owing to the thread on the nut and rod, the knife is advanced in spiral direction, cutting the fruit into a continuous spiral ribbon. Then, on cutting through the fruit from the circumference to the center, it will be divided into a number of separate slices, all of a uniform thickness. The rod is adjustably held in the handle so that it can be lengthened or shortened for different sizes of fruit. It may also be replaced by a rod with a different thread for slices of a different thickness.



VEGETABLE OR FRUIT SLICER.

RECENTLY PATENTED INVENTIONS.

Of Interest to Farmers.

HARVESTER.—C. O. Wyman, Anoka, Minn. The prime object in this case is the provision for a four-wheeled frame and to drive all of the operative parts of the harvester and its binding mechanism equally from said wheels, thus giving the apparatus a more certain and stable base and providing mechanism which will operate with uniform efficiency unaffected by inequalities in the ground over which the machine is being drawn and by turning of the machine from one side to the other.

HOLDER FOR SICKLE-BARS.—O. Norton, Hartington, Neb. Mr. Norton's invention relates to means for supporting such cutting members as the sickle-bars of reapers and mowers in proximity to a grinding-wheel to permit them to be properly sharpened. Its principal objects are to provide a simple and convenient holder for this purpose.

COTTON-SEED LINTER.—W. C. Robinson, Pensacola, Fla. The seed is fed into the chamber through the hopper and is there passed over the surface of a drawing-cylinder by the float. The rough surface of the granular material draws the lint from the seeds and carries it between the upper grate-bars, which retain the seeds themselves. The lint is then carried along by the cylinder until removed by brushes and discharged from an opening. The seed when cleaned becomes small enough to pass between the drawing-cylinder and the finger-bars, whereupon it falls on and is directed by the lower grate through an opening. Means provided for seizing and removing the lint from seeds has no tendency to break the former. Independence of upper and lower grate-bars permits separate adjustment to suit conditions.

Of General Interest.

AMMUNITION-CARRIER.—E. T. Gibson, Matawan, N. J. The primary object of the invention is to provide an ammunition carrier, which is supported on the shoulder in such manner that none of the packages come between the arm and the body. The second object is to arrange the device so that the cartridge-bearing packages may be readily removed and replaced with fresh ones.

BILL-HOLDER.—R. Ferris, Monmouth, Ill. Mr. Ferris's invention relates to improvements in devices for holding bills in offices or by collectors. The object of his improved device is to provide a very simple and inexpensive construction, which will be found very efficient in practice.

HOOP.—Anna M. Clark, Hoboken, N. J. The hoop is provided with a number of bells mounted to swing from its inner face, the clappers of the bells operating as the hoop is rolled. The bells are so spaced that one will not interfere with the other, and none of them will retard the motion of the hoop, but rather tend to augment and prolong the rolling action of the hoop after it is set in motion.

WEIGHT-INDICATOR FOR WEIGHING-SCALES.—D. F. Curtin, Chicago, Ill. This device is arranged to give notice to the dealer when the approximate quantity of material is on his scales, so that the remaining portion may be carefully added to avoid overplus. This overplus of weight which is frequently given, especially in busy times, is a serious factor of loss, particularly in such commodities as sugar, where the profits are small. The present invention is an improvement on one previously patented by Mr. Curtin.

NON-REFILLABLE BOTTLE.—H. Brewster, New York, N. Y. Mr. Brewster's invention relates to a bottle provided with devices for preventing it from being refilled, after its original contents have been decanted. Upon attempting to force liquid through the neck into the bottle, a set of valves are caused to seat, thus closing the mouth of the bottle and preventing it from being refilled.

HARNESS.—A. D. Carpenter, Woodbridge, N. J. Many attempts have been made to improve the present form of saddletrees and their accessories; but heretofore no one has succeeded in devising a saddletree having a removable check hook provided with efficient means for securing it in place. The object of the present invention is to secure this important result.

HYGROMETER ATTACHMENT.—J. H. Gerrer, Elreno, Oklahoma Ty. The apparatus is designed to be applied to cigar cases for indicating the degree of moisture or dryness within the case, so that the cigars may be kept at a uniform degree of moisture without deteriorating. It may also be applied to the interior surface of the glass window of an incubator, a hothouse, or any other situation where it is desirable to know and to regulate the degree of moisture. The present invention is an improvement on a hygrometer attachment previously patented by Mr. Gerrer.

VALVE.—O. M. Alexander, Anniston, Ala. The object of the invention is to provide an improved valve for use with liquid, steam, gas, or air vessels, pipes, and faucets, and it is more particularly an improvement upon the valve for which Mr. Alexander has filed a separate application. The distinguishing feature of both valves is the construction of the valve proper, and its arrangement relative to its seat in such manner that the pressure of liquid or steam upon the inner side of the valve holds it to the seat, and the outflow passage is on the outer side of the valve.

BUNG.—J. Franke, New York, N. Y. This bung is capable of uses for all purposes to which bungs are applied, but is especially adapted for use upon beer and ale barrels and the like. The principal objects of the invention are to provide means whereby the tube of a faucet can be introduced through the bung into the barrel without danger of any of the contents being discharged except through the faucet. Mr. Franke has invented another bung the main object of which is to provide means whereby a tube such as those commonly used for drawing liquids such as the above can be inserted in a key applied to the bung and the key turned in such a manner as to permit the tube to be forced entirely through the bung into the barrel without obstruction.

GUN-CLEANER.—E. M. Moos, W. Hardin, and F. A. Bernard, Lincoln, Ill. In this patent the invention is an improvement in gun-cleaners, having for an object to provide a novel construction by which to clean the accumulations from within the barrels of guns. The construction is simple, easily operated, and will be found to operate efficiently for the desired purpose.

CONCRETE COMPOSITION.—L. Lane, Toledo, Ohio. This composition consists of an aggregate and a cementing material proper, which unite, and thereby produce a concrete substance having special properties—such as durability, lightness, strength, uniformity of texture, etc.—one special property being the capacity of the substance to receive and retain nails driven therein without breaking or chipping under hammer blows. The composition is made in four ways, more or less allied, and is adaptable for a great variety of purposes.

AWNING-SUPPORT.—C. E. Yenor, Rhinelander, Wis. The support is of simple construction and can be readily adjusted into different positions. Its construction prevents straining the covering or the awning when it becomes wet or dry. The invention is most useful as a support for the canopy or awning carried over small pleasure boats or launches; but it may be applied to various situations where desirable to adjust the awning into various positions to keep off sun or rain.

MATTRESS-ENVELOP.—Josephine Van Slyke, Detroit, Mich. This enveloping-cover is readily applied and removed, perfectly protects the entire surface of the mattress-cloth from contact with anything which might soil or infect it with disease germs, may be quickly exchanged for a clean one at proper intervals of time, thus conducing to personal comfort of the occupant of the bed, affords complete sanitary protection, and reduces wear of mattress fabric to a minimum.

SHEARS AND SCISSORS.—O. C. Abbott, Butte, Mont. The action of conferring a drawing and shearing movement to the normally upper blade of the instrument as used, is effected by the provision of two spaced rock-arms as connections between the cutting-blades, which arms are so disposed that the quick opening movement of the blades is effected with a limited divergence of the handle-bows by the location of one rock-arm that serves as a fulcrum near the bows. The relative position of the two arms adapts them for joint action as toggle-levers, increasing the manual power applied upon the bows for closure of the blades and the shear-cutting of material with which they engage.

Heating and Lighting.

INCANDESCENT GAS-LIGHTING.—C. Scott-Snell, 51 Victoria street, Westminster, Middlesex, England. The invention consists in a system comprising a number of burners, each burner being supplied with gas and with air under a relatively very small pressure through a comparatively large conduit of small resistance, such air-supply being obtained conveniently from a fan driven by a suitable motor, preferably an electric motor. The several branches from the conduit connecting to the burners are also of large bore and arranged without taps or the like, so that the resistance of the conduit and its branches is practically the same, whether the burners are in use or not. The system is of great value in flour-mills or dusty warehouses.

STENCIL-FRAME AND MOUNTING THEREFOR.—H. J. Palmer, New York, N. Y. Mr. Palmer's invention has reference to stencil-frames and mounting therefor, his particular object being to produce a stencil-frame suitable for street-lamps and used for advertising purposes, also for reflecting the light in a particular zone.

CHANDELIER.—T. D. Greene, Davenport, Wash. The object of the inventor is to produce a chandelier which may be easily adjusted to different heights. The body of the chandelier carrying an arm and electric lights may be raised or lowered. Means are provided to lock the body frictionally against further movement. Under ordinary circumstances it is not necessary to readjust a part of the means once the same has been adjusted properly, so that a substantial frictional resistance is afforded to the movement of the chandelier-body. On this account it is usually simply necessary to grasp the lower part of the chandelier and force it up or down.

Machines and Mechanical Devices.

FIRE-ESCAPE.—D. S. Sebastian, Wallace, Idaho. The invention relates to improvements in fire-escapes, the object being to provide a portable escape that may be quickly raised and lowered and also leveled or tilted laterally when necessary. It will also be found convenient for the use of linemen in stringing wires or making overhead repairs.

TICKET-PUNCH.—R. T. Piscicelli, Corso Umberto 1, No. 23, Naples, Italy. The machine which forms the object of the present invention is provided with as many compartments as there are colors—that is, prices of the tickets—and each compartment has a counter, which counts the disks falling into it. By this arrangement the counting of the disks is mechanically performed. The machine is further provided with a locking device which prevents its working when the actuating-bar is pulled by mistake without the ticket being inserted.

TYPE-WRITING MACHINE.—T. C. Smith, Spokane, Wash. One purpose of this invention is the provision of a simple, durable, and economic machine capable of being readily transported from place to place and operated without an inking-ribbon and to provide adjustable padinking devices capable of supplying two or more colors of ink, together with a wiping-section, any portion of which pads may be quickly brought into position for use.

GAGE FOR HAT-SEWING MACHINES.—W. Jasper, New York, N. Y. The present application is a continuation of Mr. Jasper's copending application for sewing-machine attachments formerly filed. It relates to gage devices adapted especially to machines for sewing together the straw bands of which straw hats are formed and also to sewing cords, tapes, and other trimmings on hats of any sort, either straw or felt. The prime object is to construct the gage so that it may have a wide variety of uses and may by simple attachments be employed for various use.

PULVERIZING-MILL.—J. H. Davis, Glens Falls, N. Y. In this patent the invention pertains to that class of mills known as "chasing-mills," and has for its object the improvement of the means for regulating the degree of fineness to which the material acted upon is to be reduced and also to practically eliminate the objectionable dust rising from such mills during their operation.

Prime Movers and Their Accessories.

EXPANSION-TURBINE.—M. Neumayer, East Orange, N. J. The aim in this improvement is to provide an expansion-turbine arranged to drive a rotary piston by impact both under initial pressure, and by the expansive force of the motor agent, thus utilizing the motive agent to the fullest advantage without requiring complicated mechanical means in the construction of the turbine.

ROTARY ENGINE.—P. Bartoletti, Brownsville, Pa. In carrying out the invention in the present patent Mr. Bartoletti has in view as an object the provision of a new and improved rotary engine which is simple and durable in construction, very effective in operation, and arranged to utilize the steam expansively to the fullest advantage.

LUBRICATING DEVICE.—R. S. Mears, Humansville, Mo. In this case the improvement has reference to a lubricating device which is capable of general use; but it is especially adapted for oiling the valves and cylinders of locomotives and can be applied to any style of engine where it is desired to oil against steam-pressure. The inventor's principal objects are to remedy numerous defects in existing types of lubricating devices.

ROTARY ENGINE.—P. F. Guthrie, Nutley, N. J. In this instance the object of the inventor is the provision of a new and improved rotary engine which is simple and durable in construction, very effective in operation, and arranged to permit convenient reversing and to utilize the motive agent to the fullest advantage.

Pertaining to Vehicles.

ATTACHING-COLLAR FOR PNEUMATIC TIRES.—J. C. N. Fouilloy, Paris, France. In this patent the inventor has for his object an attaching-collar for fixing around the pneumatic tires of automobiles the leather bands, so called "non-slipping protecting devices," of any system not cemented on the pneumatic tires.

VEHICLE-WHEEL.—T. Appleton, New York, N. Y. The purpose of the improvement is to provide a cushion-tire for vehicle-wheels, particularly wheels used upon automobiles, and to so construct the tire that it will be gradually compressed under the weight of the vehicle where it engages with the ground and gradually expanded throughout the remaining portion of its surface, providing for a minimum of shock while passing over uneven ground and a maximum of elasticity.

LUBRICATOR.—H. M. Lofton, Atlanta, Ga. By this invention Mr. Lofton seeks to provide, in connection with a shaft having inner and outer bearings and a sleeve encircling said shaft between the bearings whereby to retain such oil as may pass from the inner to the outer bearings along the shaft, a return-channel through which the oil which may from time to time be fed to the outer bearing may be returned to the inner bearing. It is especially designed for use in connection with the transmission-gear of an automobile.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 7403.—For manufacturers of up-to-date machinery and apparatus for a canning factory.

For logging engines. J. S. Mundy, Newark, N. J.

Inquiry No. 7404.—For manufacturers of safety matches, i. e., those which have a specially prepared igniting surface.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 7405.—Wanted, case-hardened steel or other metal cylinders, 20, 30 and 40 inches long, 10¼ or 10 3-16 inches outside diameter, surface to be perfectly true and smooth longitudinally and circumferentially; walls ¼ inch thick, or less.

Drying Machinery and Presses. Biles, Louisville, Ky.

Inquiry No. 7406.—For manufacturers of machines and appliances for a quarry.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 7407.—For manufacturers of electrical process for smelting iron.

Adding, multiplying and dividing machine, all in one. Felt & Tarrant Mfg. Co., Chicago.

Inquiry No. 7408.—For manufacturers of small combination locks.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 7409.—For parties making or selling ⅛ or 3-16 inch flexible wire rope.

I sell patents. To buy, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 7410.—For manufacturers of marine gasoline engine of about 1½ h. p., and who would be willing to sell the necessary castings and working drawings.

WANTED.—Patented specialties of merit, to manufacture and market. Power Specialty Co., Detroit, Mich.

Inquiry No. 7411.—For manufacturers of pickering-drawing machines.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company, Foot of East 138th Street, New York.

Inquiry No. 7412.—For dealers in aluminum and makers of aluminum goods.

EXPORT TRADE WANTED.—Agency for France of patented novelties and specialties. Henri Vilcoq, 458 Broadway, New York City.

Inquiry No. 7413.—For manufacturers of wireless telegraph apparatus.

WANTED.—Ideas regarding patentable device for water well paste or mucilage bottle. Address Adhesive, P. O. Box 773, New York.

Inquiry No. 7414.—For manufacturers of celluloid in sheets.

WANTED.—First-class draftsmen on Automobile Tools. Apply to Superintendent, Pope Manuf. Co., Hartford, Conn.

Inquiry No. 7415.—For manufacturers of machines for digging ditches for tile drains.

LATEST ADVERTISING NOVELTIES.—High-grade Illustrating, Designing and Printing. Catalogues a Specialty. Smith & Berkley, Holland Bldg., St. Louis, Mo.

Inquiry No. 7416.—For manufacturers of "Ransom Mixer" for concrete work; also "White's Improved Road Oiler" for hot or cold oil.

Mechanical Engineer would like to correspond with parties wishing improved labor-saving machinery or tools. A. E. Sanford, 8 Bowman St., Rochester, N. Y.

Inquiry No. 7417.—For manufacturers of hand circular saws.

FOR SALE.—A small manufacturing plant in operation, well equipped for manufacturing wrought specialties. Reason for selling, other interests. Address Box 1163, Hartford, Conn.

Inquiry No. 7418.—For manufacturers of thin woods and veneers for scroll work; also imported hard woods.

Mechanical devices of brass, aluminum, and kindred metals manufactured for inventors and patentees, and marketed on royalty, when desired. Imperial Brass Mfg. Co., 241 So. Jefferson St., Chicago, Ill.

Inquiry No. 7419.—For manufacturers of machines for making pins, needles, pencils, nails, hinges, screws, etc.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, wood fiber machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 7420.—For manufacturers of non-reusable bottles.

Absolute privacy for inventors and experimenting. A well-equipped private laboratory can be rented on moderate terms from the Electrical Testing Laboratories, 548 East 80th St., New York. Write to-day.

Inquiry No. 7421.—For manufacturers of machines that will crush Sea Island cottonseed; also manufacturers of traction engines.

Manufacturers of all kinds sheet metal goods. Vending, gum and chocolate, matches, cigars and cigarettes, amusement machines, made of pressed steel. Send samples. N. Y. Die and Model Works, 508 Pearl St., N.Y.

Inquiry No. 7422.—For manufacturers of wood-cutting machines.

WANTED.—An A 1 foreman to take charge of machine shop. Manufacturer of gas and gasoline engines and accessories. Address with references, Foreman, Box 773, N. Y.

Inquiry No. 7423.—For manufacturers of supplies used in lapidary work.

NOTICE.—New Tool Holder for Painters and Decorators. For sale or lease. Appertains to paint manufacturers as advertising novelty. Of interest to hardware men, etc. For particulars address E. H. Purdy, Box No. 45, West Somers, Westchester Co., N. Y.

Inquiry No. 7424.—For manufacturers of fire-proof fabrics.

WANTED.—An up-to-date Foreman in a Machine Shop doing general work. A person with some knowledge of paper-making machinery preferred. State age, experience and references. Machinist, Box 773, N. Y.

Inquiry No. 7425.—For manufacturers who use small pieces of white horsehide and sheepskin.

WANTED.—A thoroughly competent millwright, one who is able to line up heavy shafting, turbine wheels and other machinery in Power Plant and Grist Mill. Must be a sober, steady man. Wages, $60 per month and house rent free. House is a good two story, eight-room brick, with good garden. Lancaster Electric Light, Heat and Power Co., Lancaster Pa.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(9818) A. B. wishes to learn more about lunar rainbows. A. Some of the correspondents of our paper who have reported upon lunar rainbows of late seem to be confusing two phenomena which are very unlike and due to entirely different causes—the rainbow and the halo. A rainbow is due to falling rain from a cloud which is on the opposite point of the horizon from the sun or moon at the time. The sun or moon cannot be very high above the horizon and have a long arc of the bow visible, not over 42 deg., at which angle none of the arch would be seen. A rainbow is a half circle at sunrise or sunset. In a primary bow the red is on the outside of the arch. If two bows are seen, the outer one has the red on the inner side of the arch. If a bow is formed by the moonlight at night, the colors are very faint, and very rarely or never can more than three colors be distinguished—red, yellow, and green. Lunar rainbows are not frequent, and one is fortunate to see one. The writer has seen two in forty years. They are doubtless formed more frequently in one's field of vision, but are so faint as to escape notice. Halos, on the other hand, occur frequently, and are seen without any difficulty in the vicinity of both the sun and the moon. The rings of colored light, seen close to the sun and the moon, or nearer than 10 deg., are called coronæ. The smallest halo has 22 deg. radius, or about half that of the primary bow, but it is a ring with the sun or moon in its center. It surrounds, when seen fully, the sun or the moon. A halo of 46 deg. radius and one of 90 deg. radius are also formed. White circles are also seen, which pass through the sun or moon and are parallel to the horizon. Where these circles cross the circle of the halo, we sometimes see so bright a spot of light that it is called a mock sun, or sun dog. Complicated figures are sometimes formed by the crossing of these circles. The halo of 90 deg. is very rarely formed. The writer has never seen but one. Halos are always at a very great height above the earth's surface, so high that water cannot exist, and the halo is formed by refraction and reflection of the light in crystals of ice. They are signs of a storm, since they indicate the saturation of the upper air, and the lower air will soon be affected. These are not discussed very fully in recent meteorologies. The reader is referred to Loomis's "Meteorology" for much interesting matter upon all these subjects.

(9819) F. I. H. asks: When are we closest to the sun—in winter or summer? A. The earth is nearest the sun early in January, and farthest from the sun early in July. This makes the winter warmer in the northern hemisphere and the summer warmer in the southern hemisphere than they would otherwise have been. Similarly, the summers are cooler in the northern hemisphere, and the winters cooler in the southern hemisphere. We in the north have the advantage at present, but in 13,000 years the conditions will be reversed.

(9820) N. W. W. asks for the difference between high and low voltages and for information relative to malleable glass. A. The limit between high and low in voltage for lighting and power is not well defined, and has never been authoritatively fixed. The Edison Company in its direct-current system has a voltage of 220, which is without doubt a low voltage. The engineer to whom you refer fixed the limit of low voltage just above this voltage. The voltage for direct-current trolley service is 500 at the motors. Many would consider this low rather than high. It is without doubt true that no one would call a higher voltage than 500 a low voltage. Anything above 500 in any service is a high voltage. As to the other question, What is a high voltage in a magneto for ignition purposes? we are not able to give this a numerical answer, and have never seen any decision on this point. But it would seem proper to call that a low-voltage magneto which would be used with an induction coil; while a high-voltage magneto would furnish a spark without an induction coil, and might furnish several hundred volts on the break circuit. This we suggest as a possible mode of drawing a line between high and low voltage magnetos, where no settled practice has been followed. Toughened or malleable glass was introduced by a Frenchman some years ago. It could be treated as you describe; but probably none of it can be had now. It had the very bad habit of going all to pieces with an explosion on the slightest scratch or crack being made in it. This glass was made by tempering in a bath of oil, just as the Rupert drops are made in a water bath, and it was in the same strained condition, ready to fly into bits whenever a line of fracture was started. It truly was tough, but it had other qualities which were not to be endured. We have seen these lamp chimneys thrown as you describe. Had they cracked, they would have gone into a million pieces all around the room. It would not be nice to see a pitcher of water or a fruit dish of preserves suddenly disappear in dust mixed with the contents of the former dish. Nor would it be safe for the eyes to have the lamp chimney perform a similar trick as one sat reading by it.

(9821) G. J. B. says: Some time ago the American gave the receipt how to make a hektograph. Please give the formula. A. The hektograph, or copying pad, is very useful in copying writing or drawings when only a limited number of copies is required. A practical hektograph may be prepared according to the following directions: Soak an ounce of gelatine overnight in enough cold water to cover it well, taking care that all the gelatine is swelled. Prepare a salt water bath by dissolving 2 ounces of common salt in 1 pint of water. Heat 6 or 7 ounces of pure glycerine over the salt water bath to a temperature of 200 deg. F. Pour off from the gelatine all the water remaining unabsorbed and add the gelatine to the hot glycerine. Continue the heating for an hour, carefully stirring the mixture occasionally, avoiding as much as possible the formation of bubbles or froth. Finally add 20 drops of oil of cloves to prevent decomposition. The composition is now ready for pouring into the vessel designed to hold it while in use. This vessel may be made especially for the purpose, or a shallow cake tin may be used. After the tin is filled with the composition it must be placed in a level position, in a cool place, free from dust, and allowed to remain for at least five hours. To prepare the pad for use it is necessary to pass a wet sponge lightly over the face of the gelatine and allow it to nearly dry before taking the first copy. If this precaution is neglected the face of the pad will be ruined by the first transfer. The writing or drawing to be copied must be made with hektograph ink, using a new steel pen. After the writing becomes dry it is placed face down on the pad and rubbed gently on the back to insure the perfect contact of every part. After remaining on the pad for about a minute remove the original and proceed to take the copies by placing the paper on the pad and removing it therefrom, always beginning at the corner. After taking the desired number of copies, or when the impression is exhausted, the pad is to be washed lightly with a sponge wet in cold water. The pad is then allowed to dry before being used again. The washing is unnecessary when the pad is left unused for two or three days, as the ink will be absorbed so as not to interfere with making a new transfer. The pad unavoidably wastes away in use. If its surface should become uneven or should it be injured in any way, it can be restored by reheating it over the salt water bath and allowing it to cool as before described. Failure in making the hektograph results from either of the following causes: Inattention to the instructions; insufficient heating of the composition; the use of too much glycerine, which prevents gelatinization. The obvious remedy for the last difficulty is to use less glycerine or more gelatine.

(9822) A. J. C. asks how to transfer prints to wood. A. First varnish the wood once with white, hard varnish, then cut off the margins of the print, which should be on unsized paper. Wet the back of it with a sponge and water, using enough water to saturate the paper, but not so as to be watery on the printed side. Then, with a flat camel's hair brush, give it a coat of transfer (alcohol) varnish on the printed side, and apply it immediately, varnished side downward, on the wood, placing a sheet of paper on it and pressing it down evenly with the hand till every part adheres. After standing a short time, gently rub away the back of the print with the fingers, till nothing but a thin pulp remains. It may require being wetted again, before all that will come (or rather ought to come) off is removed. Great care is required in this operation, that the design or printed side be not disturbed. When this is done and quite dry, give the work a coat of white hard varnish, and it will appear as if printed on the wood.

(9823) P. M. B. asks for solders for nickel. A. For fine or high-grade nickel: Three parts of yellow brass, 1 part of sterling silver. For low-grade nickel: Fifteen parts of yellow brass, 5 parts of sterling silver, 4 parts of zinc (pure or plate zinc). Melt the brass and silver with borax for a flux, and add the zinc in small pieces, stir with an iron rod, pour into a slab mold, and cool slowly, when it can be rolled thin for cutting.

(9824) C. L. L. asks how to amalgamate zincs. A. This is accomplished in several ways: 1. By dipping the zinc in dilute sulphuric acid and then dipping the end of it into a small quantity of mercury, after rubbing the surface with a brush. 2. Dissolve 1 pound of mercury in 5 pounds of nitro-muriatic acid (nitric acid 1 part, muriatic acid 3 parts). Heat the solution gently to hasten the action. When a complete solution of the mercury is effected, add 5 pounds more of nitro-muriatic acid. The solution should be applied with a brush, as immersing the zinc in it is wasteful. 3. To the bichromate solution commonly used in batteries, add to every pint of solution 1 drachm of bisulphate of mercury or a similar amount of nitrate of mercury (mercury dissolved in nitric acid). By employing this method, the amalgamation of the zincs is maintained continuously after the first amalgamation, which must be accomplished by method 1 or 2. 4. In the Bunsen, Grove, or Fuller battery the amalgamation may be accomplished by placing a small quantity of mercury in the cells containing the zincs. 5. Place a little mercury in a saucer with some dilute sulphuric acid. Dip the zincs into dilute acid. Then with a little strip of zinc or galvanized iron touch the mercury under the acid and rub it on the zinc. This will transfer a little to the surface, and a few minutes' rubbing will make the zincs as bright as silver. A very small globule of mercury is enough for a single plate.

(9825) C. J. W. asks for a formula for gluing leather to iron. A. There is a constant inquiry as to the best plan for fastening leather to iron, and there are many recipes for doing it. But probably the simplest mode, and one that will answer in a majority of cases, is the following: To glue leather to iron, paint the iron with some kind of lead color, say white lead and lamp black. When dry, cover with a cement made as follows: Take the best glue, soak it in cold water till soft, then dissolve it in vinegar with a moderate heat, then add one-third of the bulk of white pine turpentine, thoroughly mix, and by means of the vinegar make it of the proper consistency to be spread with a brush, and apply it while hot; draw the leather on quickly, and press it tightly in place. If a pulley, draw the leather round tightly, lap, and clamp.

(9826) S. Y. G. asks how to remove silver nitrate stains in using the wet plate process in photoengraving. A. In the manipulation of the nitrate of silver bath solutions in photography, the operator frequently receives stains of the salt upon his clothing, which are not very attractive in appearance. Stains or marks of any kind made with the above silver solution or bath solution may be promptly removed from the clothing by simply wetting the stain or mark with a solution of **bichloride** of mercury. The chemical result is the change of the black-looking nitrate of silver into chromate of silver, which is whiter or invisible on the cloth. **Bichloride** of mercury can be obtained at the drug stores. 2. Sodium sulphite, 1 ounce; chloride of lime, ½ ounce; water, 2 ounces. Mix. Use a nail brush. 3. Dip the fingers into a strong solution of cupric chloride. In about a minute the silver will be converted into a chloride, and may then be washed off with hyposulphate of soda solution. 4. The immediate and repeated application of a very weak solution of cyanide of potassium (accompanied by thorough rinsings in clean water) will generally remove these without injury to the colors.

(9827) C. A. J. asks how to compute the elements of a safety valve. A. Let W = the weight, L = the distance between center of weight and fulcrum in inches, w = weight of lever in pounds, g = distance between center of gravity of lever and fulcrum in inches, l = distance between center of valve and fulcrum in inches, V = weight of valve and spindle, A = area of valve in square inches, P = pressure at which the valve is to blow off, per square inch. Then the weight required to balance a given pressure at any given distance on the lever will be by the formula:

$$W = \left\{ (P \times A) - \left(V + \frac{(w \times g)}{l} \right) \right\} \times \frac{l}{L}$$

When the weight is at hand and known, and the distance is required, then

$$L = \left\{ (P \times A) - \left(V + \frac{(w \times g)}{l} \right) \right\} \times \frac{l}{W}$$

The elements between the brackets to be computed first. To obtain the area of the valve, multiply the square of the diameter by 0.7854.

(9828) P. W. T. asks for a starch gloss.

A. Borax	2½	ounces.
Gum arabic	2½	ounces.
Spermaceti	2½	ounces.
Glycerine	6¾	ounces.
Distilled water	2¼	pints.

A few drops of some sweet-scented essence. Add 6 spoonfuls of the gloss to 6¾ ounces boiling starch.

(9829) A. J. asks how to temper gun springs. A. To temper gun springs, heat them evenly to a low red heat in a charcoal fire, and quench them in water with the cold chill off, keeping them immersed until reduced to the temperature of the water. Place an iron pan containing lard oil and tallow, in about equal quantities, over a fire, and place the springs therein, and heat the pan until its contents take fire; then hold the springs in the flames, turning them over and over and dipping them occasionally in the oil to keep them blazing; when the oil adhering to them blazes freely when they are removed from the flames, place them aside to cool off.

(9830) F. C. U. asks for a varnish for polished metal. A. Take bleached shellac, pounded in a mortar; place the bruised fragments into a bottle of alcohol until some shellac remains undissolved; agitate the bottle and contents frequently and let the whole stand till clear; pour off the clear fluid. This forms the varnish. Warm the metal surface, and coat with a camel hair brush. If not perfectly transparent, warm the varnish before a fire or in an open oven until it becomes clear. Common orange shellac answers equally well, and for large surfaces even better, as it is more soluble than the bleached variety, and coats more perfectly, but care must be taken not to use the varnish insufficiently diluted. 2. Digest 1 part of bruised copal in 2 parts of absolute alcohol; but as this varnish dries too quickly, it is preferable to take—

Copal	1 part.
Oil of rosemary	1 part.
Absolute alcohol	2 or 3 parts.

This gives a clear varnish as limpid as water. It should be applied hot, and when dry it will be found hard and durable.

(9831) R. L. N. says: 1. Please explain to me an alternating current, how it is made, and why it is used? A. An alternating current is produced in all dynamos. This is changed into a direct current by the commutator on the armature shaft of direct-current dynamos. There are no dynamos which generate direct currents. The alternating current is now used very widely without changing it into a direct current because it requires a much simpler machine, it can be transmitted to a distance much more easily, and transformed to higher or lower voltages much more cheaply than can the direct current. 2. How fast does smell travel without any air currents, or does it not travel at all? A. We have no data as to the velocity with which odors can diffuse themselves. We do not suppose there is a single velocity, but that different odors are transmitted with different speeds. There is no reason why odoriferous particles should not be diffused through space in the same manner as other gaseous or solid particles. 3. Would this not be a good cause of the Northern Light: Reflection of sun's rays on the northern ice? But if it is really caused by electricity, *how* is it caused? A. It does not seem to us to be probable that the Aurora Borealis is caused by reflected light. One fact against this theory is that the aurora is most common in the winter when the Arctic regions are in the darkness of continual night. There is no sunlight there at that time. There is no other reasonable theory for the aurora except that it is an electrical phenomenon in the higher regions of the atmosphere. 4. I have an electric pocket light, and where the contact point touches the battery there is formed a little black spot on the battery which stopped the current. I had to file it off before the lamp would light. Please tell me what it was and what caused it? A. The heat at the contact point of your battery burned the metal, forming an oxide, which is not a conductor of electricity. Consequently, no current could flow until you had removed the black layer of oxide.

(9832) H. D. F. asks: Please advise through Notes and Queries column if it is advisable to connect lightning rods (by riveting and soldering) to a metal roof at various points, and connecting the roof with the ground through a regular lightning-rod cable, which passes down and is insulated from the side of the building by glass insulators. Is it necessary that these rods be connected together on the roof by a separate metal conductor, and if so, should not the whole system be insulated from the metal roof and sides of the building by some form of insulators? A. Lightning rods should be connected as firmly as possible to all metal work on the roof or upper part of a building. It is well to tie all cables together by cross cables or wires. Glass insulators should not be used, but the rods should be closely connected to the building, and, most important of all, a good moist ground should be provided at the lower end of the rod. We have many times given good plain instructions about lightning rods in Notes and Queries.

(9833) J. H. B. asks: In taking a thin piece of sheet copper or brass and placing a common stitching needle or some other piece of steel on the surface, and in moving a horseshoe magnet under it the needle will follow the magnet; but at the same time the magnet will not attract the copper, or anything of that nature. Now, can you kindly inform me of any thin material, say not over 1-32 or 1-8 of an inch in thickness, that will effectually break the current of magnetism? A. No material can cut off the action of magnetism excepting iron, and this must be thicker than 1-8 inch to do it effectively. Iron acts as a screen for magnetism by furnishing an easier path for the magnetic lines of force than air furnishes.

(9834) T. S. P. asks: Can you inform me whether or not electricity finds in molten brass or copper a better conductor while in this hot fluid state than in the usual hard state, and if a very powerful current of electricity was turned on to a pot of melted brass, would it move the liquid from positive to negative side? A. Melted metals are not as good conductors as they are in the solid condition. All metals have a positive temperature coefficient, which is to say that their electrical resistance increases with rise of temperature. A liquid conductor may be made to move by a powerful current of electricity, but we doubt whether one could see any such motion in a pot of melted brass.

NEW BOOKS, ETC.

ELEMENTARY EXPERIMENTAL MECHANICS. By A. Wilmer Duff, M.A. New York: The Macmillan Company, 1905. 12mo.; pp. 267. Price, $1.60.

Here an attempt is made to combine theory and practice as closely as possible. The author believes that success in teaching is in proportion to the extent to which the active initiative of the student is aroused, and advocates laboratory work of the right kind. The exercises in the book have been chosen chiefly with a view to the elucidation of principles, while the need of an adequate degree of precision in the necessary measurements has been borne in mind. The directions for the experiments have not been made so full as to leave nothing to exercise the judgment of the student. Condensed formulæ for calculation and tabular forms for reporting have not been supplied. The work is carefully written and will prove of great assistance to the student.

STRUCTURAL AND FIELD GEOLOGY. By James Geikie, LL.D., D.C.L., F.R.S., etc. New York: D. Van Nostrand Company, 1905. Large 8vo.; pp. 435. Price, $4.

This book was written for beginners in field geology, but will prove of great value to students who are preparing for professions in which some knowledge of structural geology is of practical importance. The subject is set forth mainly from the view of pure science, although the student of applied science will have little difficulty in distinguishing between the matter of general interest and that which bears directly on his own professional pursuits. To aid in this discrimination, two sizes of type are used, the smaller type being reserved for details of discussions of import mainly or exclusively to students of pure science. The intelligent student is expected to use his own discretion with regard to the matter in larger type. The illustrations are numerous and beautiful. The subject is well presented and will be of value to the civil engineer, mining engineer, architect, agriculturist, and public health officer.

DAS LÖTEN UND DIE BEARBEITUNG DER METALLE. Anleitung zur Darstellung aller Arten von Lot, Lötmitteln und Lötapparaten sowie zur Behandlung der Metalle während der Bearbeitung. Handbuch für Praktiker. Nach eigenen Erfahrungen bearbeitet von Edmund Schlosser. 35 illustrations. Third edition, revised and enlarged. Vienna and Leipsic: A. Hartleben, 1905. 12mo.; pp. 229. Price, $1.50.

The fact that Mr. Schlosser's book on soldering has passed through three editions, would certainly speak for its popularity in German. It must be confessed that the work is in every way practical, giving as it does, processes which the author has tried himself and formulae for the effectiveness of which he can personally vouch.

CONCRETE-STEEL. By W. Noble Twelvetrees. New York: Whittaker & Co., 1905. 12mo.; pp. 218. Price, $1.90.

This work is a treatise on the theory and practice of reinforced concrete construction, and the author's desire is to present definite and reliable information relative to concrete-steel construction. No treatise of convenient form and dimensions has hitherto been published in the English language for the guidance of engineers, architects, and others interested in the use of the new material. In preparing this book the author has preserved a strict continuity of treatment, commencing with the physical properties of concrete and steel, and the effects of their joint action. For facilitating reference, the different chapters are divided into numbered articles, and the various formulæ given are based, as far as practicable, upon a common notation, for which an index is supplied.

ADVANCED MECHANICAL DRAWING. By Alpha Pierce Jamison, M.E. New York: John Wiley & Sons, 1905. 8vo.; pp. 177. Price, $2.

The writer, instructor in the preparation of all the engineering students in Purdue University in mechanical drawing, has compiled a series of progressive notes on the subject calculated to give a working knowledge of the principles of graphic representation, offering such examples as will acquaint the student with the conventions of art, and presents them in book form under the title "Advanced Mechanical Drawing." The work is divided into two parts; Part I. being "A Course in Elementary Mechanical Drawing," and Part II. a course in "Advanced Mechanical Drawing." The book is purely elementary and does not treat of design, being preliminary to that subject. There are 27 full-page plates and 117 figures in the text. It is an excellent text-book for engineering students.

STRENGTH OF BEAMS, FLOORS, AND ROOFS. By Frank E. Kidder. New York: David Williams Company, 1905. 8vo.; pp. 222. Price, $2.

This book is a compilation of articles contributed by the author to Carpentry and Building, covering a period of six years. Some new tables have been added, and the tables and engravings numbered consecutively. Otherwise, the author has preserved the elementary character of the original articles. The book will be of great assistance to young mechanics and draftsmen who are taking up the study

of the subject without an instructor. It is illustrated by 164 engravings from original drawings.

Lectures on Iron-Founding. By Thomas Turner, M.Sc., A.R.S.M., F.I.C. London: Charles Griffin & Co., 1905. 8vo.; pp. 136. Price, $1.50.

These lectures were originally delivered to the evening classes of the School of Metallurgy of Birmingham, to an audience consisting chiefly of men who were actually engaged in the iron-founding and allied industries, to whom a detailed description of practical manipulation would have been superfluous. They were so well liked that the author was induced to publish them in book form. A number of practical illustrations and a folding plate accompany the work.

Engineers' Turning. By Joseph Horner, A.M.I.Mech.E. New York: D. Van Nostrand Company, 1905. 8vo.; pp. 404; 448 illustrations. Price, $3.50.

This is a handbook for working engineers, technical students, and amateurs. The author has attempted to cover the subject of turning, as practised to-day in large shops, in as comprehensive a manner as is possible within a single volume. The principles and practice in the different branches of turning are considered and thoroughly illustrated. All the different kinds of chucks, of both usual and unusual forms, are shown. An important section of the book is given up to modern turret practice; another section is devoted to drilling, boring, etc., while yet a third section is devoted to screw-cutting and examples of turret work. One of the chapters on tool holders illustrates a large number of standard types, while the last chapter contains considerable information regarding high-speed steels and their work. The numerous tools used by turners, and also all other adjuncts of the lathe, are illustrated in detail. While the book has been written from the engineer's point of view, it will also prove of value to amateurs who desire a full acquaintance with the most recent practice and developments in the art of turning.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending October 17, 1905

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Hay, straw, etc., machinery for pressing, T. J. Corning 802,156
Head motion, H. D. McLeod........ 802,016
Heating composition, Bamberger & Bock... 802,256
Heating furnace, F. Kernan 802,295
Hide or leather working machine, F. J. Perkins 802,084
Hides preparatory to tanning, apparatus for treating, J. W. Deckert 802,139
Hinge, floor, W. M. Potter........ 802,313
Hoe attachment, S. J. Garner........ 801,978
Hoisting apparatus, J. W. & B. Haley..... 802,039
Hoisting jack, F. H. Roewe........ 802,323
Hoisting machine, R. W. Basom........ 801,838
Hoisting mechanism, D. W. Smith........ 802,023
Husking machine, O. C. Moore........ 802,227
Ice shaver, L. Olson 802,308
Inhaler, A. de Trey 802,339
Insulator, tree, C. W. Dunton........ 802,096
Iron and steel, compound for coating, N. A. Bibikov 801,842
Jack. See Hoisting jack.
Jewel setter, roller, F. Hyde........ 802,045
Jewelry, article of, J. B. J. Chaumet...... 802,267
Jigger, dyer's, Herminghaus & Gruschwitz.. 801,871
Junction box, T. J. Murphy........ 801,895
Knitting machine, B. T. Steber........ 801,930
Knitting machine, fashioning, H. Janssen.. 801,984
Knitting machine needles, making, Dodge & Currier 802,141
Ladder, F. T. Newton 802,017
Lamp attaching implement, incandescent, S. Olafson 801,902
Lamp burner, C. I. Miller........ 802,055
Lamp, electric arc, E. Viale........ 801,939
Lamp, vapor burning, J. Heilbron........ 802,355
Lantern, A. F. Prahm 802,085
Ledgers, temporary binders, files, and the like, lock for loose leaf, G. Higginson.. 802,044
Leg brace, R. R. Norwood........ 801,901
Lens, E. A. Trapp 801,935
Level, plumb, W. H. Gray........ 802,162
Life preserver, chair, Kuhnen & Spader.... 802,221
Life preserver, chair to be used as, G. Fentrick 802,275
Lime and lime-containing substances and certain novel products of said process, process of slaking, C. Ellis........ 802,354
Linotype machine attachment, C. J. O'Brien 802,108
Liquids from tins, tap for drawing off, J. Helleur 802,363
Loader, coal or ore, W. C. Whitcomb...... 801,948
Lock, F. J. Vieweg 802,062
Lock, C. Salviolo 802,240
Lock, M. F. Walck 802,341
Lock, hook, E. Weit 802,343
Locomotive tender, C. M. Taylor........ 802,335
Loom warp-stop motion, Ricketson & Chesbrough 802,086
Loom weft tension means, H. S. Furminger 802,186
Lubricants, examination of, K. Wilkens.... 801,952
Lubricator, J. R. Markle 802,008
Lubricator, A. R. Behnke 802,072
Magnetic separator, Wetherill & Wilkens.. 801,947
Mail bag holder, R. B. Rice........ 802,320
Mattress, antisore, E. Lambotte 801,885
Measuring instrument, electric, M. M. Wood 802,130
Measuring machine, F. J. Perkins........ 802,109
Messages, machine for coding and decoding, J. S. Beeman 801,964
Metal handling device, H. Aiken........ 802,131
Metal spinning apparatus, E. Oldenbusch... 802,082
Mining apparatus, R. Baggaley 802,348, 802,349
Mixing machine, J. B. Cross........ 802,199
Mold box, W. H. Fisher........ 801,976
Molding machine, B. F. Potter........ 802,234
Mop wringer, J. A. White........ 801,949
Motor starting device, explosion, W. Hagspiel 802,284
Mouth prop, J. B. Besant........801,840, 801,841
Music leaf turner, H. L. Wilson........ 801,953
Music roll, C. D. Haskins........ 802,189
Needle, Miller & Gilmore 802,010
Nozzle, syringe, S. B. Shiley........ 801,924
Oil applying device, C. S. Young........ 801,955
Oil cake trimming machine, A. W. French, 802,034, 802,035
Oil from wicks, burning, J. F. W. Jost.... 801,878
Oil separator, J. N. Sturner........ 802,243
Oiler, axle or wheel, Lauffer & Gallagher.. 802,298
Ore separator, magnetic, R. R. Moffatt.... 802,170
Organ pneumatic coupler,, J. Slawik....... 802,333
Packing expanding device, Johnson & McDermott 801,985
Packing, metallic, J. Badeker......801,959, 801,960
Paddle wheels, gearing for feathering, J. S. Hillyer 801,982
Painting machine, D. Reyam 802,318
Paper clip, A. S. Brooks........ 802,262
Paper folding machine, Nind & Julyan..... 802,057
Paper holder, J. J. McNamara........ 801,897
Paper holder, roll, J. E. Hill........ 802,145
Paper, machine for hanging wall, L. D. Howell 802,292
Perforating machine, wire, C. Andersen.... 802,253
Perforating machines, etc., contact device for electrical, D. Stockman 801,932
Phonograph recorder, O. L. Hibbard....... 802,212
Phonographic record, M. Bryant 802,135
Photograph, colored, L. Schill 802,022
Piling, metal sheet, J. R. Wemlinger..... 801,946
Pipe band fastening, A. W. Hight........ 802,213
Pipe cutting tool, F. A. Headson........ 801,866
Pipe hanger, Robinson & Conway........ 802,087
Pipe wrench, G. M. Gealy........ 802,187
Pipes, device for stopping leaks in, T. P. Fitzgerald 802,276
Pipes, etc., hanger for, W. Houghton..... 802,103
Piston head, C. M. Seitz........ 802,327
Planter discharge chute, corn, W. L. Beall. 802,066
Planter marking attachment, corn, Barnett & Sanders 801,962
Plaster compounds, making ingredients for, J. H. Hirt 801,873, 801,874
Plates, etc., treating steel armor, R. A. Hadfield 802,188
Platform. See Scaffold platform.
Plow, R. P. Rodgers 802,322
Plows, rolling shield for, J. L. Balmer.... 801,961
Pocket knife, J. F. Connell........ 801,970
Poultry roost bracket, L. J. Davis......... 801,972
Powder grain, perforated, H. C. Aspinwall. 802,347
Power transmission device, electric, H. McNulta 801,898
Press, F. L. White 802,128
Pressure regulator, E. V. Anderson....... 802,132
Printing accent or letter former, G. W. Dettner 802,272
Pruning saw, C. T. Holmes........ 802,290
Pump, P. H. Deis 802,353
Pump or motor with oscillating piston, P. Samain 801,917
Pump valve, T. Giller 802,037
Pumping apparatus, oil well, E. L. Gosse.. 801,981
Punch, pricking, C. E. Traxel........ 802,247
Purse and handkerchief holder, combined, R. K. Hohmann 802,289
Quantity meter, R. Schmidt 802,328
Radiator, J. D. Karnaghan 802,294
Radiator disks, die for forming, B. Briscoe 802,029
Rail joint, C. B. Rush........ 802,174
Railway, elevated, J. W. Abernethy........ 801,832
Railway road beds, apparatus for ballasting, G. H. Cravens 802,157
Railway switch, J. J. Clark 802,069
Railway switch, J. M. Powell 802,236
Railway switch, overhead, F. Schraudner... 802,119
Railway tie and heating device therefor, C. C. Chapman 802,196
Railway ties, tie cap for metallic, A. P. Bamberger 802,092
Railway wagons and the like, compressed air brake for, C. Luyers........ 802,051
Rake and stacker, combined, Schenck & Thomson 802,241
Ratchet wrench, A. Wood 801,954
Receptacle closure, hermetic, W. A. Lorenz, 802,001 to 802,003
Reducing metals and making alloys, H. S. Blackmore 802,153
Reel, Kleinman & Tolke 802,219
Rifle cleaning rod, F. E. Muzzy........ 802,014
Roasting furnace, F. E. Marcy........ 802,007
Rock crusher and pulverizer, A. Scott...... 801,921
Rolling apparatus, Lambert & Cardozo..... 802,048
Rotary engine, Misner & Mallalieu......... 801,891
Sanding device, A. L. Moss........ 802,230
Sash fastener, S. F. & D. E. Myers....... 802,304
Sash frame and sash, J. G. Roseboom..... 802,116
Sash frame and sash, R. G. Holzer....... 802,163
Scaffold platform, E. Van Etten........ 802,126
Screw driver, H. Tiardoks 802,248
Scrub brush, mop, and wringer, combined, E. Hilker 802,214

Seed planter and fertilizer distributer, J. A. Bouchillon 802,261
Seesaw, multiple, R. Whitcomb 802,127
Separating pyrrhotite from chalcopyrite and gangue, J. N. Judson 801,879
Sewing machine feeding mechanism, W. C. Free 802,098
Sewing machine trimmer, V. W. Glover 801,980
Shaft coupling, F. J. Creque 802,269
Shaft lining ring and tubbing, F. H. Heise 802,210
Shafts or similar articles, machine for turning crank, J. T. Moltrup 802,011
Shears, spring-actuated means for increasing the tension between the blades of, H. L. Hopkins 802,164
Sheet feeding machine, O. S. Beyer 802,181
Shoe dress, A. E. McQuiston 801,899
Shoes, making, F. Engel 802,075
Shooting apparatus, cattle, B. Behr 801,839
Shovel teeth, detachable point for power, J. Treacy 802,178
Show case, F. Weber 801,944
Sign and actuating means therefor, changeable, E. O. Pohl 801,905
Sign, electric, J. L. Dawes 802,201
Signaling, fog distance, J. Patten 802,020
Sledge, cycle, J. Baldauf 802,255
Sleeve fastener, M. J. Bender 802,258
Slitting machine for cutting sheet metal can-body blanks, rotary, F. Rudolphi 801,916
Smoke guard support, S. Walker 801,940
Soot cleaner for boilers, W. Eichelberger, 801,857, 801,858
Soot collector and smoke purifier, A. Zacharias 801,956
Speed controlling and reversing mechanism, F. A. Gerling 802,282
Speed indicator, A. C. Hobbs 802,077
Spinning machine, L. W. Gill 802,161
Square, bevel, C. B. Parnell 802,083
Stalk puller and cutter, combined, D. L. Palmer 802,310
Stall bottom, R. Newall 801,900
Steam and water meter and motor, A. H. Carpenter 801,849
Steam boiler feeding apparatus, W. J. Pickering 801,906
Steam trap, F. Bason 801,837
Steering gear, F. A. Law 802,356
Stirrup attachment, J. Englehart 802,274
Stool, folding camp, H. Breiding 801,966
Storage bin, A. E. Brown 802,263
Store service apparatus, C. J. Miller 801,890
Sulfids, separating nickel and copper, A. Monell 802,012
Swimming appliance, E. J. McKittrick 802,306
Syringe, G. Rehmann 801,912
T-square clamp, K. Dougan 802,202
Table decoration, W. C. Codman 802,268
Talking machine sound box, R. L. Gibson. 801,979
Target, aerial, Heikes & Clippinger 801,867
Target, flying, E. D. Schmitt 802,329
Telegraphy, multiplex system of, G. A. Cardwell 801,967
Telephone and other wires to insulators, device for attaching, McDaniel & Barr .. 802,015
Telephone, portable, W. N. Clark 801,851
Telephone system, E. J. Hall 801,864
Temperature, producing flames of high, K. Kuppers 802,297
Threaded parts to each other, fixing, E. T. Byshe 802,138
Tilting furnace, F. H. Treat 802,151
Timepiece dial train, B. H. Rhoads 801,914
Tires and the like, apparatus for molding rubber, J. L. G. Dykes 802,159
Tires, metallic tread for resilient, W. C. Lyon 802,005
Toilet seat attachment, J. V. Matteson .. 802,106
Tool, bush, W. H. Van Sickel 801,937
Tool, combination, A. C. Smith 802,334
Tool holder, C. W. Grant 802,206
Tooth, artificial, C. Rauhe 801,911
Toy, L. S. Bixler 802,260
Toy, sounding, M. B. Holmes 801,876
Toy hook and ladder truck, H. T. Kingsbury 802,296
Toy hoop, musical, J. Hunter 802,078
Tracker board, E. de Kleist 802,079
Tramways, extension track or apron for overhead, A. E. Brown 802,134
Transmission of telephonic and telegraphic currents over the same line, apparatus for the simultaneous, C. Turchi 801,936
Transom opener, G. C. Weil 802,063
Trap, J. Shepherd 801,923
Trolley base, C. E. Gierding 802,160
Trolley harp, E. D. Rockwell 802,173
Trolley wheel, G. Loffi 801,999
Trousers stretcher, Barrell & Knight 801,836
Truck, car, W. P. Bettendorf 802,067
Truck, tongue, Pridmore & Webber, 802,315, 802,316
Truck, transfer, W. P. Hussey 802,166
Tube cutter, E. Johnson 802,215
Turbine, H. Wagner 802,024
Turbine engine, M. D. Kalbach 802,293
Turbine, steam, H. Wagner 802,025
Type setting machine, W. G. Reynolds 801,913
Underwaist, I. Miller 802,302
Universal joint, G. W. Toney 801,934
Universal joint, V. & V. Lorenc 802,299
Utensil handle, H. G. Kuck 802,147
Valve, E. V. Anderson 802,091
Valve, E. F. Riddle 802,239
Valve, E. H. Schulze 802,330
Valve, automatic relief, L. A. Rabourn 802,113
Valve, balanced slide, J. B. Allfree 801,834
Valve gear, explosive engine, E. R. Uhlin .. 802,125
Vault, grave, M. J. Faivre 802,142
Vehicle spring wheel, D. C. Master 802,009
Vehicle wheel, A. Cousen 801,852
Vehicle wheel, G. A. Schoche 802,118
Vehicle wheel, J. M. Ledford 802,332
Vehicles, body and gear supporting frame for pedaled, G. H. Barschow 802,179
Veneer machine, E. F. Smith 801,925, 801,926
Ventilator, J. Lorenz 802,000
Ventilator, S. L. Morse 802,013
Vise, B. Newman 802,232
Vise, bench, C. Hanimann 802,040
Voting machine, A. A. Farwell 801,861
Wagon, dump, H. S. Hoy 802,165
Washing machine, C. E. Miller 802,054
Washing machine gearing, W. Nahrwolt ... 802,056
Watch fob safety attachment, A. G. Doane 802,140
Watch protector, J. Middlebrook 802,225
Water, apparatus for purifying, R. T. Weaver 801,943
Water closet, sanitary, F. P. Sheridan ... 802,120
Water cooler and refrigerator, J. W. Brown 802,192
Water gate, Kellar & Thomason 801,990
Water meter, N. P. Fenner, Jr. 802,097
Water motor, J. C. Howard 802,104
Water tube boiler, C. H. Smith 802,121
Wax, artificial, J. Lewy 802,169
Way or track, P. B. Sullivan 802,244
Weighing machine, G. H. Denison 802,271
Well device, oil, C. E. Downs 802,182
Well strainer, G. B. Kisner 801,995
Wheel. See Elastic wheel.
Wind shield, J. Eysseric 802,032
Wind wheel, Miller & Ziegler 802,149
Windmill, B. R. Harrington 802,144
Winding machine, C. F. Nickel 802,359
Winding machines, controlling means for, S. W. Wardwell 801,941
Window draft stop, E. A. Veller 802,340
Window sash, sheet metal, E. G. Budd 802,194
Window screen, C. W. Allen 801,958
Window screen, F. Folden 802,185
Window screen, metal, H. W. & W. W. Watson 802,090
Wire drawing machine, J. H. O'Donnell ... 802,019
Wire or rod cutter, T. D. Millea 802,053
Wire stretcher, Bost & Bolen 802,154
Wire stretcher and splicer, H. F. Bonesteele 801,843
Wires, etc., moisture-proof case covering for the terminals of lead armored insulated, Teush & Hargis 802,337
Wood, preserving, W. E. Everette 801,859
Woodworking machine, W. S. Mellen 801,889
Wrench, H. B. Schiller 801,919
Wrench, W. P. O'Brien 802,018
Wrench, J. R. Patty 802,360

TRADE MARKS.

Baking soda, saleratus, and baking powder, Church & Dwight Co. 46,901
Beer, J. Conrad 47,019
Bonbons, Walter M. Lowney Co. 47,017, 47,018

Boots and shoes, leather, Geo. D. Witt Shoe Co.	46,983
Canned fruits and vegetables, R. C. Williams & Co.	47,010
Cards, playing, New York Consolidated Card Co. 46,935, 46,937, 46,938,	46,942
Cars, motor, Autocar Co.	46,992
Cement or cement composition, bituminous, Warren Brothers Co. 46,946,	46,947
Chains, plated, Theodore W. Foster & Bro. Co.	46,943
Champagne or sparkling wine, American Wine Co.	46,969
Cheese, Threefoot Bros. & Co.	46,900
Cigars, De Leon Cigar Co., Inc.	46,918
Cocktails, Bluthenthal & Bickart	46,949
Coffee pots, Silver & Co.	46,928
Condensers, surface and jet, Wheeler Condenser and Engineering Co.	46,998
Cotton piece goods, Massachusetts Cotton Mills ....46,904 to 46,908,	47,008
Counting and indicating devices, mechanical, Veeder Manufacturing Co.	46,996
Cream, toilet, Artesia Cream Co.	46,930
Cycles and parts thereof, Pope Manufacturing Co.	46,989
Dental cutters, Buffalo Dental Manufacturing Co.	46,975
Dyspepsia, remedy for, G. C. Frye	46,919
Envelop, Samuel Cupples Envelope Co.	47,013
Files and rasps, G. & H. Barnett Co. .46,951,	46,952
Files and rasps, Nicholson File Co. .46,957 to	46,961
Flour, wheat, Phœnix Flour Mill	46,894
Gas mantles, self-lighting incandescent, Auto Lighter Co.	46,916
Gelatin, S. S. Kingery	46,924
Gin, P. J. Bowlin Liquor Co.	46,963
Gloves, Frederick Loeser & Co.	47,007
Hair restoratives, B. F. Kerr	46,923
Hats, Boogher, Force & Goodbar Hat Co.	46,915
Hats, men's and boys', Gauss-Langenberg Hat Co.	46,914
Headache remedies, C. C. Hemm	46,921
Horseshoes, toe calks for, Bay State Forge	46,971
Hose, fabric, Eureka Fire Hose Co.	47,006
Hosiery, R. J. Fisher	46,913
Knives, butcher and pocket, Knapp & Spencer Co.	46,985
Knives, shoe, Stephen Richard Co.	46,964
Lamp glasses and globes, Macbeth-Evans Glass Co. ....47,022 to	47,026
Lamp wicks, C. A. Schneider	47,012
Leggings, leather, Chanavas & Slazenger, Inc.	46,976
Liniment, Dr. Peter Fahrney & Sons Co.	46,931
Links, repair and connecting, Marine Hardware and Equipment Co.	46,987
Liquid preparation for cleaning, G. Talbot	47,014
Liver regulator and blood purifier, G. M. Upton	46,945
Macaroni, spaghetti, and vermicelli, C. R. Splivalo & Co. 46,895,	46,896
Matches, parlor, Threefoot Bros. & Co.	46,944
Medicinal preparations for the cure of certain named diseases, Fitchmul Co.	46,932
Medicinal tonic preparation, Charles H. Phillips Chemical Co.	47,029
Milk, condensed, Sanipure Food Co.	46,899
Molasses and syrup, Dugue & Co.	46,897
Nail pullers, Smith & Hemenway Co.	46,966
Nails, horse, Standard Horse Nail Co. 46,991,	47,011
Nicotin solution and paper saturated therewith, Kentucky Tobacco Product Co.	46,922
Oil, G. W. Cole Co.	47,021
Ointments, liniments, salves, and lotions, A. V. M. Sprague	46,929
Paint pigments, Lowe Bros. Co.	47,016
Pantaloons, A. Kory & Sons	46,910
Paper, bromid, Defender Photo Supply Co.	47,002
Paper printing-out, Defender Photo Supply Co.	47,004
Papers, bond, linen, ledger, wedding, and index bristol, B. D. Rising Paper Co.	46,972
Papers, developing, Defender Photo Supply Co.	47,003
Periodical, magazine, E. L. Bill	46,979
Phonographs, National Phonograph Co.	46,988
Pianos, Baldwin Co.	46,993
Pills used for cure of headache, dizziness, biliousness, etc., Carter Medicine Co.	46,917
Remedy for the prevention and cure of diseases of the mucous membrane, J. S. Leonhardt	46,925
Remedy for treatment of affections resulting from the stomach, bowels, liver, and kidneys, E. G. Michel	46,927
Sal-soda, Church & Dwight Co.	46,902
Sewing machines, needles for, American Supplies Co	47,001
Sheetings and drillings, Gaffney Manufacturing Co.	47,020
Sheetings and drillings, bleached, brown, and colored cotton, J. L. Salter. .46,903,	47,028
Shirt waists and shirt waist suits, Hagedorn-Merz Co.	46,911
Shoes, leather, H. Childs, Jr.	46,977
Shot shells and cartridges, Winchester Repeating Arms Co.	47,000
Slicers and kraut cutters, vegetable, E. C. Atkins & Co.	47,005
Starch, J. Morningstar	46,898
Steam boilers, flue expanders for, J. Faessler Manufacturing Co.	46,984
Suspenders, hose, Frank & Gutmann	46,912
Taps and dies, Patterson, Gottfried & Hunter, Ltd.	46,962
Tin and terne plates, Follansbee Brothers Co.	46,981
Tools, reloading, Winchester Repeating Arms Co.	46,967
Waists, ladies' and boys', A. Neuville	47,009
Wall hangings, burlaps dyed and prepared for use as, Cott-A-Lap Co.	47,015
Washing machines, Wahle Foundry and Machine Works	46,997
Washing machines, White Lily Washer Co.	46,999
Watches, Hampden Watch Co.	46,933
Watches, Abraham & Straus	46,968
Watches and watch parts, Hampden Watch Co.	46,934
Watches, mainsprings for, Henry Zimmern & Co., Inc.	46,920
Whisky, Lee Broom & Duster Co.	46,926
Whisky, R. Eisen & Co.	46,950
Whisky, Erdreich Bros. & Marx	46,953
Whisky, Loeb, Bloom & Co.	46,954
Whisky, I. Michelson & Bros	46,955
Whisky, A. Myers	46,956
Whisky, C. Sandheger	46,965
Whisky, J. Berkowitz	46,973
Whisky, Bott & Cannon	46,974
Whisky, Cousins Supply Co.	46,978
Whisky, Erdreich Bros. & Marx	46,980
Whisky, Freiberg, Meyer & Co.	46,982
Whisky, Wm. Lanahan & Son	46,986
Whisky, L. Rosenzweig	46,990
Whisky, Kayser & Hegner Co.	46,995
Whisky, Rosskam, Gerstley & Co.	47,027
Whisky, Scotch, Bemis-Richelieu Importing Co.	46,948
Wine, Bayer, Schwartz & Co.	46,970
Writing fluids, Carter's Ink Co.	46,994

LABELS.

"Roulette Cards," for roulette cards, A. K. Ferris	12,392

PRINTS.

"Evered," for paint, National Paint and Varnish Co.	1,436
"Record's Patent Folding Portiere Doors," for folding portiere doors, folding portiere screens, folding portiere partitions, and folding portiere show window backs, G. J. Record	1,435

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.